

## REGARDING PZ's DEPARTING POST

Classical physics is remarkably successful at predicting the reality which we all experience and is indispensable as an engineering tool. In contrast, QM has mathematics which may be adjusted to give numbers which may agree with measurements, but it is at the expense of abandoning reality. My motivation for pursuing CQM was to attempt to apply first principles congruent with reality over all scales starting with the application of Maxwell's equations to the observation that the hydrogen atom is stable to radiation in vacuum or isolation. The results have been remarkable in terms of the diversity and accuracy of problems which can be solved and understood intuitively such as the prediction of the mass of the top quark and the acceleration of the expansion of the universe before the observations were made. Practical applications were sought. CQM makes predictions about novel reactions of atomic hydrogen. These predictions are being confirmed experimentally in a broad range of internally consistent and reinforcing tests. The novel hydrogen chemistry of BLP is no longer a theoretical argument but an experimental reality. The technological ramifications are extraordinary and vital.

PZ and his colleagues have tremendous vested interests in preserving QM. He has stated that he will stab a knife in the heart of CQM, but it appears that his blade has dulled or he has run out of diatribes about how I should believe the nonsensical and fantastical trappings of QM because he knew Schwinger or so and so. In any event, I feel I have a professional obligation to respond despite the fact that these are regurgitations of his old arguments which have already been dealt with.

## REGARDING ANY ATTACKS ON PZ:

As stated in Melcher's post of 6/27/01

"It was not Dr. Zimmerman's criticisms of the hydrino theory that got him into potential trouble. Dr. Zimmerman represented in an abstract on the APS (American Physical Society) website that he was speaking on behalf of the U.S. State Department, and that the U.S. State Department and the U.S. Patent Office had fought back with success against BlackLight Power."

PZ's abstract is of public record in the documents that BlackLight

filed in its law suit against the Patent Office to right the Patent Office's withdrawing BlackLight's chemical patents from issuance.

### **REGARDING THE PZ CHALLENGE AND THE NONRADIATION CONDITION:**

This challenge is nonsensical and clearly demonstrates the fundamental lack of PZ's understanding of Maxwell's equations and the application of first principles to quantum problems. This issue was dealt with in my prior posts such as:

Mills wrote:

>> A probability wave in a 1D box (electron only moves along one axis with  
>> barriers at the ends) is not a physical problem. No real world data exists  
>

DMc74965@aol.com wrote:

>  
>No real world data is required for this test case. All the test case has to  
>show is that states below the alleged ground state exist. You claim "first  
>principles" and "closed form equations". Such a simpler test case should  
>demonstrate the application of these principles--and if they exist they must  
>be able to be applied to the situation and derive the fractional energy  
>states. That is what the 1d square well does for the schrodinger  
>equation--it  
>demonstrates the procedure and how it is applied, and shows how bound states  
>require quantized energy levels. The quantized energy levels arise from the  
>BOUNDARY CONDITIONS applied to the solution of the schrodinger equation. So  
>tell us how to apply YOUR boundary conditions and what equation to use.

>

>Once you master the square well then the same procedure can be applied to  
>the hydrogen atom. Just tell me the equations to use and I will do it myself.  
>If I can solve it and obtain the results you claim, fractional energy states  
>below the ground state, I will have PhD mathematicians I know examine it for  
>correctness and I will submit it myself to a recognized peer review journal  
>for publication.

Mills also wrote:

>> A probability wave in a 1D box (electron only moves along one axis with  
>> barriers at the ends) is not a physical problem. No real world data exists  
>> to test any theoretical model based on this abstraction. The electron can  
>> not be one dimensional and is not a probability wave in any of 1, 2, 3, 4,  
>

DMc74965@aol.com also wrote:

>That's a nice dodge. If there is really a hydrino theory, there must be a  
>method of solution that can be applied to the situation described. If CQM is  
>a "GUT", then it should be able to get the results of standard quantum  
>mechanics, in addition to its own results. What equation do I apply? Tell me  
>and I will do it myself. I would also point out that the 1d box problem is  
>easily extended to 2 and 3 dimensions. So if 1d is the objection, then solve  
>it for a 3 d box with infinite potentials on all sides. But we all know any  
>equation, such as the schrodinger equation, or the wave equation,

can be

>taken down to 1 dimension. The wave equation can be solved for 1 space

>dimension and one time dimension. The response we get from Mills is exactly

>what I expected-a lot of descriptive arguments but no mathematics. I suspect

>that Dr. Mills has no equation he can apply to demonstrate the existence of

>the quantized states of quantum mechanics \*and\* his fractional energy states.

If you insist in working in a fantasy world of purely mathematical abstractions, you should consider what is waving as an electromagnetic

field corresponding to an abstraction of a photon--not a real photon, and

the walls of the barrier as source current, just an abstraction and not really source current corresponding to an electron. (Footnote 1).

Then a

first box would represent the ground state it would only contain a single

field line ending on a one dimensional charge at each barrier. Then consider a series of larger boxes that are integers of the size of the first and another series  $1/\text{integer}$  smaller than the first. These boxes would contain 1D photons--only an abstraction and not real. The nonreal

photon standing waves of each of these photons would be resonant in the

1D resonator cavities. The box of course gets bigger in an abstraction of an excited state and in the limit is infinitely big, and the box gets smaller in an abstraction of a fractional state to the limit of the fine structure times the size of the first box.

No Ph.D. in mathematics is needed. I guess you realize that mathematics as applied in these types of problems is merely addition in

various guises. With mathematics, it is possible to represent an infinite

number of models with limitless fantasy--probability waves, virtual particles, negative energy of the vacuum, polarization of the vacuum by

virtual particles, renormalization, effective nuclear charge, ionic terms  
in the perturbation series, fermion propagators, virtual photon annihilation, virtual photon emission and reabsorption, virtual electron  
positron annihilation, photon propagators, plethora of postulated super-symmetry virtual particles which make contributions such as smuon-neutralino and sneutrino-chargino loops, neutrino oscillation, worm  
holes, parallel universes, parallel mind universes, quantum telepathy,  
entanglement, spooky actions at a distance, dark energy, exotic particles  
comprising dark matter, the universe from nothing, big bang-inflation,-deceleration-reacceleration of the universe, and so on and so on.

The challenging aspect is understanding the physics principles of the real world. The quantum mechanical example you give only means that  
a trigonometric function is periodic and you may conjecture that a barrier exists at two nodes of the function which is continuous from -infinity to +infinity. Then of course in the real world you can Not equate what is waving to an electron since acceleration is implicit in the waving, and Maxwell's equations demands that any accelerating point  
charge radiate. This consequence of the model actually disproves quantum  
mechanics since it unequivocally demonstrates that the Schrodinger solution for the electron violates Maxwell's equations.

Going back to the real world. A point charge undergoing periodic motion accelerates and as a consequence radiates according to the Larmor  
formula. Although an accelerated point particle radiates, an extended  
distribution modeled as a superposition of accelerating charges does not  
have to radiate (See ref. 1-5). It is possible to have an infinite number of charges or an ensemble of charge oscillating in such as  
way as  
to cause destructive interference or nodes in all directions. In order to obtain the condition, if it exists, that the electron current

distribution must satisfy such that the electron does not radiate, the electromagnetic far field is determined from the current distribution. Time dependent components of that field must vanish. See

#### APPENDIX I

Nonradiation Based on the Electromagnetic Fields and the Poynting POWER

VECTOR section which applies this physics to a real world model of an

electron and also see THE BOUNDARY CONDITION OF NONRADIATION AND THE

RADIAL FUNCTION - THE CONCEPT OF THE "ORBITSphere" section [6] which

applies the boundary condition of Haus [1] (Footnote 2) to a real world

model of an electron.

Footnote 1. It is not even correct to view this abstraction as the projection of the 3D plus time world into 1D.

Footnote 2. For non-radiative states, the current-density function must not possess spacetime Fourier components that are synchronous with waves traveling at the speed of light.

1. Haus, H. A., "On the radiation from point charges", American Journal

of Physics, 54, (1986), pp. 1126-1129.

2. Abbott, T. A., Griffiths, D. J., Am. J. Phys., Vol. 153, No. 12, (1985), pp. 1203-1211.

3. J. Daboul and J. H. D. Jensen, Z. Physik, Vol. 265, (1973), pp. 455-478.

4. P. Pearle, "Classical electron Models", Electromagnetism: Paths to Research, edited by D. Teplitz, Plenum, New York, Chp. 7 Pt 6, Radiationless Motion" (1982), pp. 237-240.

5. G. Goedecke, Phys. Rev., Vol. 135B, (1964), pp. 281-288.

6. R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, January 2000 Edition, BlackLight Power, Inc., Cranbury, New Jersey, Distributed by Amazon.com. Latest edition posted at [www.blacklightpower.com](http://www.blacklightpower.com).

PZ continues to misunderstand and misrepresent the nonradiative condition.

1.) from my post of 7/31/01:

>when the experimenters say they did  
>no such thing. Or that the Haus condition applies to bound  
>orbiting electrons.

I explicitly give Haus's condition from his paper and show how his work can be applied to a bound extended particle rather than a point particle.

On p 2. of R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, July 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, posted at [www.blacklightpower.com](http://www.blacklightpower.com) appears

" Proof that the condition for nonradiation by a moving point charge is that its spacetime Fourier transform does not possess components that are synchronous with waves traveling at the speed of light is given by Haus [1]. The Haus derivation applies to a moving charge-density function as well because charge obeys superposition. The Haus derivation is summarized below."

On page 36 of R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, July 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, posted at [www.blacklightpower.com](http://www.blacklightpower.com) appears

"The Boundary Condition

The condition for radiation by a moving charge is derived from Maxwell's equations. To radiate, the spacetime Fourier transform of the current-density function must possess components synchronous with waves traveling at the speed of light [1]. Alternatively,

For non-radiative states, the current-density function must not possess spacetime Fourier components that are synchronous with waves traveling at the speed of light.

#### Derivation of the Condition for Nonradiation

The condition for radiation by a moving point charge given by Haus [1] is that its spacetime Fourier transform does possess components that are synchronous with waves traveling at the speed. Conversely, it is proposed that the condition for nonradiation by an ensemble of moving point charges that comprises a charge density function is that its spacetime Fourier transform does NOT possess components that are synchronous with waves traveling at the speed of light. The Haus derivation applies to a moving charge-density function as well because charge obeys superposition. The Haus derivation is summarized below."

Please try to be professional and refrain from misrepresentations.

Randy Mills

2.) The CQM solution of the  $n=1$  state is ELECTROSTATIC AND MAGNETOSTATIC AND ANY COMPETENT PHYSICIST WOULD IMMEDIATELY RECOGNIZE THAT IT IS NONRADIATIVE.

3.) Other have published that although an accelerated point particle radiates, an extended distribution modeled as a superposition of accelerating charges does not have to radiate (See Abbott, T. A., Griffiths, D. J., Am. J. Phys., Vol. 153, No. 12, (1985), pp. 1203-1211; J. Daboul and J. H. D. Jensen, Z. Physik, Vol. 265, (1973), pp. 455-478; P. Pearle, "Classical electron Models", Electromagnetism: Paths to Research, edited by D. Teplitz, Plenum, New York, Chp. 7 Pt 6, Radiationless Motion" (1982), pp. 237-240; and G. Goedecke, Phys. Rev., Vol. 135B, (1964), pp. 281-288).



4.) In addition to using the nonradiative constraint of Haus, Abbott, T. A., Griffiths, or G. Goedecke, I have also shown in Appendix I of Chp 1 that CQM solutions for p, d, f, etc. electrons do not radiate from consideration of the Poynting Power vector with vanishing of the far electromagnetic fields.

The results of CQM are remarkable. For example, the electron  $g$  factor is derived in close form with 11 figure match between calculated and observed values; whereas in QED it is purely fabricated and requires the existence of virtual particles. This renders it fatally flawed in terms of predicting a corresponding inescapable infinite cosmological constant and particle emission by blackholes as discussed below from my pervious post.

CQM results were shown previously:

I took a couple of days to answer some previous HSG questions. The plan is that the "Grand Unified Theory of Classical Quantum Mechanics" on our web page ([www.blacklightpower.com](http://www.blacklightpower.com)) will be updated while I'm on vacation.

NEW MATERIAL:

ELECTRON  $g$  FACTOR (new pages 74-85)

The postulated quantum electrodynamics (QED) theory of  $g/2$  is based on the determination of the terms of a postulated power series in  $\alpha/2$  where each postulated virtual particle is a source of postulated vacuum polarization that gives rise to a postulated term. The algorithm involves scores of postulated Feynman diagrams corresponding to thousands of matrices with thousands of integrations per matrix requiring decades to reach a consensus on the "appropriate" postulated algorithm to remove the intrinsic infinities. The remarkable agreement between Eqs. (1.204) and (1.205) demonstrates that  $g/2$  may be derived in closed form from Maxwell's equations in a simple straightforward manner that yields a result with eleven figure agreement with experiment < the limit of the experimental capability of the measurement of the fundamental constants that determine  $\alpha$ .

In Appendix II: Quantum Electrodynamics is Purely Mathematical and Has No Basis in Reality, the Maxwellian result is contrasted with

the QED algorithm of invoking virtual particles, zero point fluctuations of the vacuum, and negative energy states of the vacuum.

#### COMMENTS ON QED (new pages 101-105)

Appendix II: Quantum Electrodynamics is Purely Mathematical and Has No Basis in Reality covers:

- fourth quantum number
- g factor
- Lamb shift
- Casimir effect

#### NONRADIATION (new pages 95-100)

In addition to Haus' condition given by Eqs. (1.44-1.45), the orbitsphere states given by Eqs. (1.64-1.65) are shown to be nonradiative with the same condition as that of Eq. (1.45) applied to the vector potential as shown in Appendix I: Nonradiation Based on the Electromagnetic Fields and the Poynting Power Vector.

#### GROUND STATE (new pages 186-188)

Addresses the lowest accessible energy state of the electron of the hydrogen atom.

Next, I will be adding the recent data from NASA that confirms my cosmological theory that the universe accelerates from an initial state of zero velocity. (See Chp. 23)

We have recently had two additional papers accepted for publication including another invited paper. We will be posting more results as time permits. Some previous independent confirmation data is now posted in the Archive section of our web page. Our presentations at the National Hydrogen Association, 12th Annual U.S. Hydrogen Meeting and Exposition, Hydrogen: The Common Thread, The Washington Hilton and Towers, Washington DC, (March 6-8, 2001) are now posted. Also, click on Technical Papers from the Site Map for current experimental results.

Randy Mills

peter zimmerman wrote:

>I am sorry to hear that. If the paper were as iron-clad as Randy seems to  
>think it is, it should have been submitted to a major physics or  
>astrophysics, or applied physics journal. If this is the fat lady singing  
>south of the south pole, then the evidence would have to be such as to  
>convince even a skeptical referee at a major journal. To be sure, Mills  
>might have to pay the editor a visit and do a little in-person sales job  
>to ensure a good hearing, but the obligation is squarely on him to  
>convince the community that he has made a major advance and replaced a  
>theory which gives the Lamb shift to, what is it now, 11 significant  
>figures or somewhere on that order.

I believe that you are mistaken and mean the electron g factor which is given to this precision in CODATA [P. J. Mohr and B. N. Taylor, "CODATA recommended values of the fundamental physical constants: 1998", Reviews of Modern Physics, Vol. 72, No. 2, April, (2000), pp. 355-495] and is widely touted as a major theoretical accomplishment of QED; whereas, the experimental values of the Lamb shift given in CODATA (pp. 374-375; p. 433) indicate that it is known experimentally to only about 5 figures.

The Lamb shift is given in closed form based on applying conservation of energy and linear momentum to the emitted photon and the electron and atom. (See pages 121-124 of R. Mills, "The Grand Unified Theory of Classical Quantum Mechanics", [www.blacklightpower.com](http://www.blacklightpower.com).) The method used by QED is based on virtual particles, negative energy

states,  
and arbitrarily disregarding infinities that even Dirac opposed. See  
1.)  
APPENDIX II Quantum Electrodynamics is Purely Mathematical and  
Has No  
Basis in Reality; 2.) R. Mills, The Nature of Free Electrons in  
Superfluid Helium--a Test of Quantum Mechanics and a Basis to  
Review its  
Foundations and Make a Comparison to Classical Theory, Int. J.  
Hydrogen  
Energy, in press, and 3.) R. Mills, "The Hydrogen Atom Revisited", Int.  
J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-  
1183.

The CQM g factor result was addressed in my post of 4/20:

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The CQM result for the muon  $g$  factor was addressed in my post of 5/14:

The muon, like the electron, is a lepton with  $\hbar$  of angular momentum.

The magnetic moment of the muon is given by Eq. (1.136) with the electron

mass replaced by the muon mass. It is twice that from the gyromagnetic

ratio as given by Eq. (2.36) of the Orbital and Spin Splitting section corresponding to the muon mass. As is the case with the electron, the

magnetic moment of the muon is the sum of the component corresponding to

the kinetic angular momentum,  $\hbar/2$ , and the component corresponding to

the vector potential angular momentum,  $\hbar/2$ , (Eq. (1.132)). The spin-flip transition can be considered as involving a magnetic moment of

$g$  times that of a Bohr magneton of the muon. The  $g$  factor is

equivalent  
to that of the electron given by Eq. (1.196).

The muon anomalous magnetic moment has been measured in a new experiment at Brookhaven National Laboratory (BNL) [29]. Polarized muons were stored in a superferric ring, and the angular frequency difference  $\omega_a$  between the spin precession and orbital frequencies was determined by measuring the time distribution of high-energy decay positrons. The dependence of  $\omega_a$  on the magnetic and electric fields is given by BMT equation which is the relativistic equation of motion for spin in uniform or slowly varying external fields [30]. The dependence on the electric field is eliminated by storing muons with the "magic"  $\gamma = 29.3$ , which corresponds to a muon momentum  $p = 3.09 \text{ GeV}/c$ . Hence measurement of  $\omega_a$  and of  $B$  determines the anomalous magnetic moment.

The "magic"  $\gamma$  wherein the contribution to the change of the longitudinal polarization by the electric quadrupole focusing fields are eliminated occurs when

$$g_{\mu} \times \beta/2 - 1/\beta = 0 \quad (1.206)$$

where  $g_{\mu}$  is the muon  $g$  factor which is required to be different from the electron  $g$  factor in the standard model due to the dependence of the mass dependent interaction of each lepton with vacuum polarizations due to virtual particles. For example, the muon is much heavier than the electron, and so high energy (short distance) effects due to strong and weak interactions are more important here [26]. The BNL Muon ( $g-2$ ) Collaboration [29] used a "magic"  $\gamma = 29.3$  which satisfied Eq. (1.206) identically for  $g_{\mu}/2$ ; however, their assumption that

this condition eliminated the affect of the electrostatic field on omegasuba is flawed as shown in Appendix III: Muon g Factor. Internal consistency was achieved during the determination of  $g_{\text{submu}}/2$  using the BMT equation with the flawed assumption that  $g_{\text{submu}}/2$  is not equal to  $g_{\text{sube}}/2$ . The parameter measured by Carey et al. [29] corresponding to  $g_{\text{submu}}/2$  was the sum of a finite electric term as well as a magnetic term. The calculated result based on the equivalence of the muon and electron g factors

$$g_{\text{submu}}/2 = 1.001\ 165\ 923 \quad (1.207)$$

is in agreement with the result of Carey et al. [29]:

$$g_{\text{submu}}/2 = 1.001\ 165\ 925 \quad (15) \quad (1.208)$$

Rather than indicating an expanded plethora of postulated supersymmetry virtual particles which make contributions such as smuon-neutralino and sneutrino-chargino loops as suggested by Brown et al. [31], the deviation of the experimental value of  $g_{\text{submu}}/2$  from that of the standard model prediction simply indicates that the muon g factor is identical to the electron g factor.

The derivations are posted at our webpage ([www.blacklightpower.com](http://www.blacklightpower.com)) See: R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, April, 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, pp. 107-118.

The Casimir effect is addressed in (pages 102-106)



## Appendix II: Quantum Electrodynamics is Purely Mathematical and Has No Basis in Reality

Randy Mills

### REGARDING QUANTIZATION

QM theory does not say why an atom radiates. Quantum states of QM refer to energy levels of probability waves. From these, emission and absorption of radiation is inferred. But QM doesn't explain why it is emitted or absorbed or why certain states are stable.

Since the Schrödinger equation offers no foundation for the stability of isolated atomic hydrogen, Feynman attempted to find a basis for the definition of the "ground state" in the Heisenberg uncertainty principle [137]. His attempt is shown to be fatally flawed in R. Mills, *The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory*, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096.

The Schrödinger equation can only yield integer eigenvalue solutions by selection or definition from an infinite number of possibilities since the solution is over all space with no boundary (i.e. 0 to infinity). In contrast, wave equation solutions with integers are common for boundary constrained systems such as waveguides and resonators.

In the CQM case, quantization arises from first principles. The angular momentum of the photon given by  $m = 1/8\pi \text{Re}[\mathbf{r} \times (\mathbf{E} \times \mathbf{B}^*)] = \hbar$  ( $m = \frac{1}{8\pi} \text{Re}[\mathbf{r} \times (\mathbf{E} \times \mathbf{B}^*)] = \hbar$ ) is conserved [5] for the solutions for the resonant photons and excited state electron functions. It can be demonstrated that the resonance condition between these frequencies is to be satisfied in order to have a net change of the energy field [6]. In contrast to QM, the correspondence principle holds. That is the change in angular frequency of the electron is equal to the angular frequency of the resonant photon that excites the resonator cavity mode corresponding to the transition, and the energy is given by Planck's equation. The predicted energies, Lamb shift, hyperfine structure, resonant line shape, line width, selection rules, etc. are in agreement with observation.

## REGARDING THE THREE DIMENSIONAL VERSUS TWO DIMENSIONAL WAVE EQUATION

I have shown in my previous posts that the three dimensional solutions have a number of problems in terms of the  $n=1$  state radiating, disagreement with experiment on 18 experimental accounts with violation of first principles as shown in R. Mills, *The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory*, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096. and R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183. In fact, the Schrödinger equation can only yield integer eigenvalue solutions by selection or definition from an infinite number of possibilities since the solution is over all space with no boundary (i.e. 0 to infinity). In contrast, wave equation solutions with integers are common for boundary constrained systems such as waveguides and resonators.

PZ has it identically opposite. Physics determines the mathematics; mathematics does not determine physics. A two dimensional wave equation plus time and its separable solutions arises from invoking Maxwell's equations to a generalized three dimensional wave equation plus time. The wave equation and the corresponding solutions are well known [McQuarrie, D. A., *Quantum Chemistry*, University Science Books, Mill Valley, CA, (1983), p. 207]. In fact, the math is identical to the familiar rigid rotor problem of quantum mechanics. And, of course the force balance is solved. The force balance equation is clearly given at Eq. (1.165).

The outline of the solution is given below. The equations are not presented due to software limitations, but are given in R. Mills, *The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory*, Int. J. Hydrogen Energy, Vol. 26, No. 10, (2001), pp. 1059-1096. Also see attachment.

# A CLASSICAL APPROACH TO QUANTUM MECHANICS

## Introduction

A theory of classical quantum mechanics (CQM) was derived from first principles by Mills [2] that successfully applies physical laws on all scales. The classical wave equation is solved with the constraint that a bound electron cannot radiate energy. The mathematical formulation for zero radiation based on Maxwell's equations follows from a derivation by Haus [18]. The function that describes the motion of the electron must not possess spacetime Fourier components that are synchronous with waves traveling at the speed of light. CQM gives closed form solutions for the atom including the stability of the  $n=1$  state and the instability of the excited states, the equation of the photon and electron in excited states, the equation of the free electron, and photon which predict the wave particle duality behavior of particles and light. The current and charge density functions of the electron may be directly physically interpreted. For example, spin angular momentum results from the motion of negatively charged mass moving systematically, and the equation for angular momentum,  $\mathbf{r} \times \mathbf{p}$ , can be applied directly to the wave function (a current density function) that describes the electron. The magnetic moment of a Bohr magneton, Stern Gerlach experiment, g factor, Lamb shift, resonant line width and shape, selection rules, correspondence principle, wave particle duality, excited states, reduced mass, rotational energies, and momenta, orbital and spin splitting, spin-orbital coupling, Knight shift, and spin-nuclear coupling are derived in closed form equations based on Maxwell's equations. The calculations agree with experimental observations.

Many great physicists rejected quantum mechanics. Feynman also attempted to use first principles including Maxwell's Equations to discover new physics to replace quantum mechanics [19]. Other great physicists of the 20th century searched. "Einstein [...] insisted [...] that a more detailed, wholly deterministic theory must underlie the vagaries of quantum mechanics" [20]. He felt that scientists were misinterpreting the data.

The results of Mills theory demonstrate that classical physical laws

describe reality on all scales. Unlike quantum mechanics which postulates that different laws apply on the atomic level, the premise of Mills theory is that a valid theory must comply with ALL of the following:

- theory must be internally consistent even between widely different phenomena
- Maxwell's equations
- conservation of matter/energy
- conservation of linear and angular momentum
- charge conservation
- first and second law of thermodynamics
- Newton's law in the low speed limit; special relativity otherwise
- general relativity (e.g. Schwarzschild metric)--no cosmological constant; and Newtonian gravitation in the weak field limit (which demands no cosmological constant)
- a vacuum is a vacuum
- constant maximum of the speed of light in a vacuum
- 4 dimensional spacetime
- the only allowed parameters are the measured fundamental constants

Quantum mechanics is based on engendering the electron with a wave nature as suggested by the Davisson-Germer experiment and fabricating a set of associated postulates and mathematical rules for wave operators. Quantum mechanics is in violation of Maxwell's equations as shown through application of Haus's condition to the Schrödinger wave functions [18]. Nonradiation based on Maxwell's equations is a necessary boundary constraint since nonradiation is observed experimentally. The short coming of QM regarding violation of Maxwell's equations and other first principles are further discussed in the Appendix.

#### **Mills Approach to the Solution of the Electron:**

Mills solves the electron by a different approach than that used to solve the Schrödinger wave equation. Rather than using a postulated wave equation with time eliminated in terms of the energy of the electron in a Coulomb field and solving the charge wave (Schrödinger interpretation) or the probability wave (Born interpretation), the solution

for the scalar (charge) and vector potential (current) functions of the electron are sought based on first principles. Mills first assumes that the functions that physically describe the mass and charge of the electron in space and time obeys the wave equation since it conserves energy and angular momentum. The solution is generalized to be three dimensional plus time. Rather than use the postulated Schrödinger boundary condition:  $\Psi \rightarrow 0$  as  $r \rightarrow \infty$ , which leads to a purely mathematical model of the electron, the constraint is based on experimental observation that the moving charge must not radiate. Application of the Haus condition based on Maxwell's equations to a generalized three dimension plus time wave equation requires that the functions must be solutions of Eq. (45), a two dimensional wave equation plus time. This is consistent with first principle laws and ultimately matches experimentation. However, it is unconventional.

The two dimensional wave equation plus time is given by McQuarrie [21]. The electron is confined to two dimensions ( $\theta$  and  $\phi$ ) plus time. Spherical harmonic functions and time harmonic functions are well known solutions of the angular and time components of the two dimensional wave equation plus time, respectively. The solutions appear in McQuarrie [22]. A constant current function is also a solution of the wave equation. A constant function corresponding to the electron spin function is added to each of the spherical harmonic functions to give the charge (mass) density functions of the electron as a function of time. The integral of a spherical harmonic function over the orbitsphere is zero. The integral of the constant function over the orbitsphere is the total charge (mass) of the electron. These functions comprise the well known s, p, d, f, etc. electrons or orbitals. In the case that such an electron state arises as an excited state by photon absorption, it is radiative due to a radial dipole term in its current density function since it possesses spacetime Fourier components synchronous with waves traveling at the speed of light.

The excited states are solved including the radii of the orbitspheres using Maxwell's equations with the traditional source current boundary constraints at the electron. Quantization arises from the equation of the photon and the electron--not from the solution of the electron alone. After all, each solution is for an excited state created by the absorption of

a photon. The solutions are analogous to those of excited resonator modes except that the cavity is dynamic. The field lines from the proton end on the current density function of the electron, and the electric field is zero for  $r > r_n$ . The trapped photons are a solution of the three dimensional wave equation plus time given by Maxwell's equations. The electrodynamic field of the photon's is a constant function plus a time and spherical harmonic function that is in phase with source currents at the electron which is given by a constant plus a time and spherical harmonic function. Only particular solutions are possible as resonant photons of the electron which is a dynamic resonator cavity. The results are in agreement with first principle physics and experimental observations of the hydrogen atom, excited states, free electron, and free space photon including the wave particle duality aspects.

### **Spin and Orbital Parameters Arise from First Principles:**

An electron is a spinning, two-dimensional spherical surface, called an *electron orbitsphere*, that can exist in a bound state only at specific radii  $r_n$  from the nucleus. (See Figure 1 for a pictorial representation of an orbitsphere.) The result for the  $n=1$  state of hydrogen is that the charge density function remains constant with each point on the surface moving at the same angular and linear velocity. The constant function solution of the two dimensional wave equation corresponds to the spin function which has a corresponding spin angular momentum that may be calculated from  $\mathbf{r} \times \mathbf{p}$  applied directly to the current density function that describes the electron. The radius of the nonradiative ( $n=1$ ) state is solved using the electromagnetic force equations of Maxwell relating the charge and mass density functions wherein the angular momentum of the electron is given by Planck's constant bar (Eq. (1.165) of [2]). The reduced mass arises naturally from an electrodynamic interaction between the electron and the proton rather than from a point mass revolving around a point nucleus in the case of Schrödinger wave equation solutions which presents an internal inconsistency since the wave functions are spherically symmetrical.

CQM gives closed form solutions for the resonant photons and excited state electron functions. Angular momentum of the photon given

by  $m = \frac{1}{8\pi} \text{Re}[\mathbf{r} \times (\mathbf{E} \times \mathbf{B}^*)]$  is conserved. The change in angular velocity of the electron is equal to the angular frequency of the resonant photon. The energy is given by Planck's equation. The predicted energies, Lamb shift, hyperfine structure, resonant line shape, line width, selection rules, etc. are in agreement with observation.

The radii of excited states are solved using the electromagnetic force equations of Maxwell relating the field from the charge of the proton, the electric field the photon, and charge and mass density functions of the electron wherein the angular momentum of the electron is given by Planck's constant bar (Eq. (1.165) of [2]).

For excited states of the hydrogen atom, the constant function solution of the two dimensional wave equation corresponds to the spin function. Each spherical harmonic function modulates the constant spin function and corresponds to an orbital function of a specific excited state with a corresponding phased matched trapped photon and orbital angular momentum. Thus, the spherical harmonic function behaves as a charge density wave which travels time harmonically on the surface of the orbitsphere about a specific axis. (See Figure 2 for a pictorial representation.) An amplitude of the corresponding orbital energy may be calculated from Maxwell's equations. Since the constant function is modulated harmonically, the time average of the orbital energy is zero except in the presence of a magnetic field. Nondegeneracy of energy levels arises from spin, orbital, and spin-orbital coupling interactions with the applied field. The electrodynamics interaction with the magnetic field gives rise to the observed hyperfine splitting of the hydrogen spectrum.

Many inconsistencies arise in the case of the corresponding solutions of the Schrödinger wave equation. For example, where is the photon in excited states given by the Schrödinger equation? And a paradox arises for the change in angular momentum due to photon absorption. The Schrödinger equation solutions for the kinetic energy of rotation  $K_{rot}$  is given by Eq. (10) and the value of the electron angular momentum  $L$  for the state  $Y_{lm}(\theta, \phi)$  given by Eq. (11) predict that the excited state rotational energy levels are nondegenerate as a function of the  $\ell$  quantum number even in the absence of an applied magnetic field,

and the predicted energy is over six orders of magnitude of the observed nondegenerate energy in the presence of a magnetic field. In the absence of a magnetic field, no preferred direction exists. In this case, the  $\ell$  quantum number is a function of the orientation of the atom with respect to an arbitrary coordinate system. Therefore, the nondegeneracy is nonsensical and violates conservation of angular momentum of the photon.

In quantum mechanics, the spin angular momentum of the electron is called the "intrinsic angular momentum" since no physical interpretation exists. The Schrödinger equation is not Lorentzian invariant in violation of special relativity. It failed to predict the results of the Stern-Gerlach experiment which indicated the need for an additional quantum number. Quantum electrodynamics was proposed by Dirac in 1926 to provide a generalization of quantum mechanics for high energies in conformity with the theory of special relativity and to provide a consistent treatment of the interaction of matter with radiation. It is fatally flawed. From Weisskopf [23], "Dirac's quantum electrodynamics gave a more consistent derivation of the results of the correspondence principle, but it also brought about a number of new and serious difficulties." Quantum electrodynamics; 1.) DOES NOT EXPLAIN NONRADIATION OF BOUND ELECTRONS; 2.) contains an internal inconsistency with special relativity regarding the classical electron radius - the electron mass corresponding to its electric energy is infinite (The Schrödinger equation fails to predict the classical electron radius); 3.) it admits solutions of negative rest mass and negative kinetic energy; 4.) the interaction of the electron with the predicted zero-point field fluctuations leads to infinite kinetic energy and infinite electron mass; 5.) Dirac used the unacceptable states of negative mass for the description of the vacuum; yet, infinities still arise. Dirac's equation which was postulated to explain spin relies on the unfounded notions of negative energy states of the vacuum, virtual particles, and gamma factors. All of these features are untenable or are inconsistent with observation. These problems regarding spin and orbital angular momentum and energies and the classical electron radius are nonexistence with CQM solutions [2].

Furthermore, Mills [24] shows that the Schrödinger equation may be transformed into a form consistent with first principles. In the case



that the potential energy of the Hamiltonian,  $H$ , is a constant times the wavenumber, the Schrödinger equation is the well known Bessel equation. Then with one of the solutions for the wavefunction  $\Psi$  (a current density function rather than a probability wave) is equivalent to an inverse Fourier transform. According to the duality and scale change properties of Fourier transforms, the energy equation of Mills theory and that of quantum mechanics are identical, the energy of a radial Dirac delta function of radius equal to an integer multiple of the radius of the hydrogen atom.

### **Mills Theory-a classical quantum theory**

One-electron atoms include the hydrogen atom,  $He^+$ ,  $Li^{2+}$ ,  $Be^{3+}$ , and so on. The mass-energy and angular momentum of the electron are constant; this requires that the equation of motion of the electron be temporally and spatially harmonic. Thus, the classical wave equation applies and

$$\left[ \nabla^2 - \frac{1}{v^2} \frac{\delta^2}{\delta t^2} \right] \rho(r, \theta, \phi, t) = 0 \quad (37)$$

where  $\rho(r, \theta, \phi, t)$  is the charge density function of the electron in time and space. In general, the wave equation has an infinite number of solutions. To arrive at the solution which represents the electron, a suitable boundary condition must be imposed. It is well known from experiments that each single atomic electron of a given isotope radiates to the same stable state. Thus, Mills chose the physical boundary condition of nonradiation of the bound electron to be imposed on the solution of the wave equation for the charge density function of the electron. The condition for radiation by a moving point charge given by Haus [18] is that its spacetime Fourier transform does possess components that are synchronous with waves traveling at the speed of light. Conversely, it is proposed that the condition for nonradiation by an ensemble of moving point charges that comprises a charge density function is

*For non-radiative states, the current-density function must NOT possess spacetime Fourier components that are synchronous with waves traveling at the speed of light.*

The Haus derivation applies to a moving charge-density function as well because charge obeys superposition. The Haus derivation is summarized below.

The Fourier components of the current produced by the moving charge are derived. The electric field is found from the vector equation in Fourier space ( $\mathbf{k}$ ,  $\omega$ -space). The inverse Fourier transform is carried over the magnitude of  $\mathbf{k}$ . The resulting expression demonstrates that the radiation field is proportional to  $J_{\perp}(\frac{\omega}{c}\mathbf{n}, \omega)$ , where  $J_{\perp}(\mathbf{k}, \omega)$  is the spacetime Fourier transform of the current perpendicular to  $\mathbf{k}$  and  $\mathbf{n} \equiv \frac{\mathbf{k}}{|\mathbf{k}|}$ . Specifically,

$$\mathbf{E}_{\perp}(\mathbf{r}, \omega) \frac{d\omega}{2\pi} = \frac{c}{2\pi} \int \rho(\omega, \Omega) d\omega d\Omega \sqrt{\frac{\mu_0}{\epsilon_0}} \mathbf{n} \times \left( \mathbf{n} \times J_{\perp}\left(\frac{\omega}{c}\mathbf{n}, \omega\right) e^{i\left(\frac{\omega}{c}\right)\mathbf{n} \cdot \mathbf{r}} \right) \quad (38)$$

The field  $\mathbf{E}_{\perp}(\mathbf{r}, \omega) \frac{d\omega}{2\pi}$  is proportional to  $J_{\perp}\left(\frac{\omega}{c}\mathbf{n}, \omega\right)$ , namely, the Fourier component for which  $\mathbf{k} = \frac{\omega}{c}\mathbf{n}$ . Factors of  $\omega$  that multiply the Fourier component of the current are due to the density of modes per unit volume and unit solid angle. An unaccelerated charge does not radiate in free space, not because it experiences no acceleration, but because it has no Fourier component  $J_{\perp}\left(\frac{\omega}{c}\mathbf{n}, \omega\right)$ .

The time, radial, and angular solutions of the wave equation are separable. The motion is time harmonic with frequency  $\omega_n$ . To be a harmonic solution of the wave equation in spherical coordinates, the angular functions must be spherical harmonic functions. A zero of the spacetime Fourier transform of the product function of two spherical harmonic angular functions, a time harmonic function, and an unknown radial function is sought. The solution for the radial function which satisfies the boundary condition is a delta function

$$f(r) = \frac{1}{r^2} \delta(r - r_n) \quad (39)$$

where  $r_n = nr_1$  is an allowed radius. Thus, bound electrons are described by a charge-density (mass-density) function which is the product of a radial delta function ( $f(r) = \frac{1}{r^2} \delta(r - r_n)$ ), two angular functions (spherical

harmonic functions), and a time harmonic function. Thus, an electron is a spinning, two-dimensional spherical surface, called an *electron orbitsphere*, that can exist in a bound state at only specified distances from the nucleus as shown in Figure 1. More explicitly, the orbitsphere comprises a two-dimensional spherical shell of moving charge.

The total function that describes the spinning motion of each electron orbitsphere is composed of two functions. One function, the spin function, is spatially uniform over the orbitsphere, spins with a quantized angular velocity, and gives rise to spin angular momentum. The other function, the modulation function, can be spatially uniform—in which case there is no orbital angular momentum and the magnetic moment of the electron orbitsphere is one Bohr magneton—or not spatially uniform—in which case there is orbital angular momentum. The modulation function also rotates with a quantized angular velocity.

The corresponding current pattern of the constant charge function of the orbitsphere corresponding to the spin function comprises an infinite series of correlated orthogonal great circle current loops. The current pattern is generated over the surface by two orthogonal sets of an infinite series of nested rotations of two orthogonal great circle current loops where the coordinate axes rotate with the two orthogonal great circles. Each infinitesimal rotation of the infinite series is about the new x-axis and new y-axis which results from the preceding such rotation. For each of the two sets of nested rotations, the angular sum of the rotations about each rotating x-axis and y-axis totals  $\sqrt{2}\pi$  radians.

Consider the electron to be evenly distributed within two orthogonal great circle current loops. Then consider two infinitesimal point masses (charges), one and two, of two orthogonal great circle current loops. The Cartesian coordinate system wherein the first current loop lies in the yz-plane, and the second current loop lies in the xz-plane is designated the orbitsphere reference frame. Consider the two point masses, one and two, in the reference frame of the orbitsphere at time zero. Point one is at  $x'=0$ ,  $y'=0$ , and  $z'=r_n$  and point two is at  $x'=r_n$ ,  $y'=0$ , and  $z'=0$ . Let point one move on a great circle toward the negative  $y'$ -axis, as shown in Figure 3, and let point two move on a great circle toward the positive  $z'$ -axis, as shown in Figure 3. The equations of motion, in the reference frame of the orbitsphere are given by

point one:

$$\dot{x}_1 = 0 \quad \dot{y}_1 = -r_n \sin(\omega_n t) \quad \dot{z}_1 = r_n \cos(\omega_n t) \quad (40)$$

point two:

$$\dot{x}_2 = r_n \cos(\omega_n t) \quad \dot{y}_2 = 0 \quad \dot{z}_2 = r_n \sin(\omega_n t) \quad (41)$$

The great circles are rotated by an infinitesimal angle  $\Delta\alpha$  (a rotation around the x-axis) and then by  $\Delta\alpha$  (a rotation around the new y-axis). The coordinates of each point on the rotated great circle is expressed in terms of the first (x,y,z) coordinates by the following transforms:

point one:

$$\begin{bmatrix} x_1 \\ y_1 \\ z_1 \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha) & -\sin^2(\Delta\alpha) & -\sin(\Delta\alpha)\cos(\Delta\alpha) \\ 0 & \cos(\Delta\alpha) & -\sin(\Delta\alpha) \\ \sin(\Delta\alpha) & \cos(\Delta\alpha)\sin(\Delta\alpha) & \cos^2(\Delta\alpha) \end{bmatrix} \begin{bmatrix} x_1' \\ y_1' \\ z_1' \end{bmatrix} \quad (42)$$

and  $\Delta\alpha' = -\Delta\alpha$  replaces  $\Delta\alpha$  for  $\sum_{n=1}^{\frac{\sqrt{2}\pi}{\Delta\alpha}} \Delta\alpha = \sqrt{2}\pi$ ;  $\sum_{n=1}^{\frac{\sqrt{2}\pi}{|\Delta\alpha'|}} |\Delta\alpha'| = \sqrt{2}\pi$

point two:

$$\begin{bmatrix} x_2 \\ y_2 \\ z_2 \end{bmatrix} = \begin{bmatrix} \cos(\Delta\alpha) & -\sin^2(\Delta\alpha) & -\sin(\Delta\alpha)\cos(\Delta\alpha) \\ 0 & \cos(\Delta\alpha) & -\sin(\Delta\alpha) \\ \sin(\Delta\alpha) & \cos(\Delta\alpha)\sin(\Delta\alpha) & \cos^2(\Delta\alpha) \end{bmatrix} \begin{bmatrix} x_2' \\ y_2' \\ z_2' \end{bmatrix} \quad (43)$$

and  $\Delta\alpha' = -\Delta\alpha$  replaces  $\Delta\alpha$  for  $\sum_{n=1}^{\frac{\sqrt{2}\pi}{\Delta\alpha}} \Delta\alpha = \sqrt{2}\pi$ ;  $\sum_{n=1}^{\frac{\sqrt{2}\pi}{|\Delta\alpha'|}} |\Delta\alpha'| = \sqrt{2}\pi$

The total orbitsphere is given by reiterations of Eqs. (42) and (43). The output given by the non primed coordinates is the input of the next iteration corresponding to each successive nested rotation by the infinitesimal angle where the summation of the rotation about each of the

x-axis and the y-axis is  $\sum_{n=1}^{\frac{\sqrt{2}\pi}{\Delta\alpha}} \Delta\alpha = \sqrt{2}\pi$  and  $\sum_{n=1}^{\frac{\sqrt{2}\pi}{|\Delta\alpha'|}} |\Delta\alpha'| = \sqrt{2}\pi$ . The current pattern

corresponding to point one and point two shown with 8.49 degree increments of the infinitesimal angular variable  $\Delta\alpha(\Delta\alpha')$  of Eqs. (42) and (43) is shown from the perspective of looking along the z-axis in Figure 4. The complete orbitsphere current pattern corresponds to all such correlated points, point one and point two, of the orthogonal great circles shown in Figure 3 which are rotated according to Eqs. (42) and (43) where  $\Delta\alpha(\Delta\alpha')$  approaches zero and the summation of the infinitesimal angular rotations of  $\Delta\alpha(\Delta\alpha')$  about the successive x-axes and y-axes is

$\sqrt{2}\pi$ . The current pattern gives rise to the phenomenon corresponding to the spin quantum number.

The fourth quantum number arises naturally in the Mills theory as derived in the Electron g Factor Section [2]. The Stern-Gerlach experiment implies a magnetic moment of one Bohr magneton and an associated angular momentum quantum number of 1/2. Historically, this quantum number is called the spin quantum number,  $s$  ( $s = \frac{1}{2}$ ;  $m_s = \pm \frac{1}{2}$ ).

Conservation of angular momentum of the orbitsphere permits a discrete change of its "kinetic angular momentum" ( $\mathbf{r} \times m\mathbf{v}$ ) by the field of  $\frac{\hbar}{2}$ , and concomitantly the "potential angular momentum" ( $\mathbf{r} \times e\mathbf{A}$ ) must change by  $-\frac{\hbar}{2}$ . The flux change,  $\phi$ , of the orbitsphere for  $r < r_n$  is determined as follows:

$$\Delta \mathbf{L} = \frac{\hbar}{2} - \mathbf{r} \times e\mathbf{A} \quad (44)$$

$$= \left[ \frac{\hbar}{2} - \frac{e2\pi r A}{2\pi} \right] \hat{z} \quad (45)$$

$$= \left[ \frac{\hbar}{2} - \frac{e\phi}{2\pi} \right] \hat{z} \quad (46)$$

In order that the change of angular momentum,  $\Delta \mathbf{L}$ , equals zero,  $\phi$  must be  $\Phi_0 = \frac{h}{2e}$ , the magnetic flux quantum. Thus, to conserve angular momentum in the presence of an applied magnetic field, the orbitsphere magnetic moment can be parallel or antiparallel to an applied field as observed with the Stern-Gerlach experiment, and the flip between orientations (a rotation of  $\frac{\pi}{2}$ ) is accompanied by the "capture" of the magnetic flux quantum by the orbitsphere. During the spin-flip transition, power must be conserved. Power flow is governed by the Poynting power theorem,

$$\nabla \cdot (\mathbf{E} \times \mathbf{H}) = -\frac{\partial}{\partial t} \left[ \frac{1}{2} \mu_0 \mathbf{H} \cdot \mathbf{H} \right] - \frac{\partial}{\partial t} \left[ \frac{1}{2} \epsilon_0 \mathbf{E} \cdot \mathbf{E} \right] - \mathbf{J} \cdot \mathbf{E} \quad (47)$$

Eq. (48) [2] gives the total energy of the flip transition which is the sum of the energy of reorientation of the magnetic moment (1st term), the magnetic energy (2nd term), the electric energy (3rd term), and the dissipated energy of a fluxon treading the orbitsphere (4th term), respectively.

$$\Delta E_{mag}^{spin} = 2 \left( 1 + \frac{\alpha}{2\pi} + \frac{2}{3} \alpha^2 \left( \frac{\alpha}{2\pi} \right) - \frac{4}{3} \left( \frac{\alpha}{2\pi} \right)^2 \right) \mu_B B \quad (48)$$

$$\Delta E_{mag}^{spin} = g \mu_B B \quad (49)$$

The spin-flip transition can be considered as involving a magnetic moment of  $g$  times that of a Bohr magneton. The  $g$  factor is redesignated the fluxon  $g$  factor as opposed to the anomalous  $g$  factor. The calculated value of  $\frac{g}{2}$  is 1.001 159 652 137. The experimental value of  $\frac{g}{2}$  is 1.001 159 652 188(4).

The Mills theory solves the wave equation for the charge density function of the electron. The time, radial, and angular solutions of the wave equation are separable. Also, the radial function for the electron indicates that the electron is two-dimensional. Therefore, the angular mass-density function of the electron,  $A(\theta, \phi, t)$ , must be a solution of the wave equation in two dimensions (plus time),

$$\left[ \nabla^2 - \frac{1}{v^2} \frac{\delta^2}{\delta t^2} \right] A(\theta, \phi, t) = 0 \quad (50)$$

where  $\rho(r, \theta, \phi, t) = f(r)A(\theta, \phi, t) = \frac{1}{r^2} \delta(r - r_n) A(\theta, \phi, t)$  and  $A(\theta, \phi, t) = Y(\theta, \phi)k(t)$

$$\left[ \frac{1}{r^2 \sin \theta} \frac{\delta}{\delta \theta} \left( \sin \theta \frac{\delta}{\delta \theta} \right)_{r, \phi} + \frac{1}{r^2 \sin^2 \theta} \left( \frac{\delta^2}{\delta \phi^2} \right)_{r, \theta} - \frac{1}{v^2} \frac{\delta^2}{\delta t^2} \right] A(\theta, \phi, t) = 0 \quad (51)$$

where  $v$  is the linear velocity of the electron. The charge-density functions including the time-function factor are

$$l = 0$$

$$\rho(r, \theta, \phi, t) = \frac{e}{8\pi r^2} [\delta(r - r_n)] [Y_l^m(\theta, \phi) + Y_0^0(\theta, \phi)] \quad (52)$$

$$l \neq 0$$

$$\rho(r, \theta, \phi, t) = \frac{e}{4\pi r^2} [\delta(r - r_n)] \left[ Y_0^0(\theta, \phi) + \text{Re} \left\{ Y_l^m(\theta, \phi) [1 + e^{i\omega_n t}] \right\} \right] \quad (53)$$

where

$$\text{Re} \left\{ Y_l^m(\theta, \phi) [1 + e^{i\omega_n t}] \right\} = \text{Re} \left[ Y_l^m(\theta, \phi) + Y_l^m(\theta, \phi) e^{i\omega_n t} \right] = P_l^m(\cos \theta) \cos m\phi + P_l^m(\cos \theta) \cos(m\phi + \omega_n t)$$

and  $\omega_n = 0$  for  $m = 0$ .

The spin function of the electron (see Figure 1 for the charge

function and Figure 4 for the current function) corresponds to the nonradiative  $n=1, \ell = 0$  state of atomic hydrogen which is well known as an s state or orbital. The constant spin function is modulated by a time and spherical harmonic function as given by Eq. (53) and shown in Figure 2. The modulation or traveling charge density wave corresponds to an orbital angular momentum in addition to a spin angular momentum. These states are typically referred to as p, d, f, etc. orbitals and correspond to an  $\ell$  quantum number not equal to zero. Application of Haus's [18] condition (Eqs. (54-56)) also predicts nonradiation for a constant spin function modulated by a time and spherically harmonic orbital function. There is acceleration without radiation. (Also see Abbott and Griffiths and Goedecke [25-26]). However, in the case that such a state arises as an excited state by photon absorption, it is radiative due to a radial dipole term in its current density function since it possesses spacetime Fourier Transform components synchronous with waves traveling at the speed of light [2].

The Fourier transform of the electron charge density function is a solution of the four-dimensional wave equation in frequency space ( $\mathbf{k}$ ,  $\omega$  space). Then the corresponding Fourier transform of the current density function  $K(s, \Theta, \Phi, \omega)$  is given by multiplying by the constant angular frequency.

$$K(s, \Theta, \Phi, \omega) = 4\pi\omega_n \frac{\sin(2s_n r_n)}{2s_n r_n} \otimes 2\pi \sum_{v=1}^{\infty} \frac{(-1)^{v-1} (\pi \sin \Theta)^{2(v-1)}}{(v-1)!(v-1)!} \frac{\Gamma\left(\frac{1}{2}\right) \Gamma\left(v + \frac{1}{2}\right)}{(\pi \cos \Theta)^{2v+1} 2^{v+1} (v-1)!} \frac{2v!}{s^{-2v}} s^{-2v} \\ \otimes 2\pi \sum_{v=1}^{\infty} \frac{(-1)^{v-1} (\pi \sin \Phi)^{2(v-1)}}{(v-1)!(v-1)!} \frac{\Gamma\left(\frac{1}{2}\right) \Gamma\left(v + \frac{1}{2}\right)}{(\pi \cos \Phi)^{2v+1} 2^{v+1} (v-1)!} \frac{2v!}{s^{-2v}} \frac{1}{4\pi} [\delta(\omega - \omega_n) + \delta(\omega + \omega_n)] \quad (54)$$

The motion on the orbitsphere is angular; however, a radial component exists due to special relativistic effects. Consider the radial wave vector of the sinc function. When the radial projection of the velocity is  $c$

$$s_n \bullet v_n = s_n \bullet c = \omega_n \quad (55)$$

the relativistically corrected wavelength is

$$r_n = \lambda_n \quad (56)$$

(i.e. the lab frame motion in the angular direction goes to zero as the velocity approaches the speed of light). Substitution of Eq. (56) into the



sinc function results in the vanishing of the entire Fourier transform of the current-density function. Thus, spacetime harmonics of  $\frac{\omega_n}{c} = k$  or

$$\frac{\omega_n}{c} \sqrt{\frac{\epsilon}{\epsilon_0}} = k \text{ for which the Fourier transform of the current-density function}$$

is nonzero do not exist. Radiation due to charge motion does not occur in any medium when this boundary condition is met.

The orbitsphere is a resonator cavity which traps photons of discrete frequencies. The radius of an orbitsphere increases with the absorption of electromagnetic energy. The solutions to Maxwell's equations for modes that can be excited in the orbitsphere resonator cavity give rise to four quantum numbers, and the energies of the modes are the experimentally known hydrogen spectrum.

*The subscript  $n$  is used in Eq. (39) and Eq. (74), the quantization condition, appears in the Excited States of the One Electron Atom (Quantization) Section of Mills [2]. Quantization arises as "allowed" solutions of the wave equation corresponding to a resonance between the electron and a photon.*

More explicitly, it is well known that resonator cavities can trap electromagnetic radiation of discrete resonant frequencies. The orbitsphere is a resonator cavity which traps photons of discrete frequencies. Thus, photon absorption occurs as an excitation of a resonator mode. The "trapped photon" is a "standing electromagnetic wave" which actually is a circulating wave that propagates along with each great circle current loop of the orbitsphere. The time-function factor,  $k(t)$ , for the "standing wave" is identical to the time-function factor of the orbitsphere in order to satisfy the boundary (phase) condition at the orbitsphere surface. Thus, the angular frequency of the "trapped photon" has to be identical to the angular frequency of the electron orbitsphere,  $\omega_n$ . Furthermore, the phase condition requires that the angular functions of the "trapped photon" have to be identical to the spherical harmonic angular functions of the electron orbitsphere. Combining  $k(t)$  with the  $\phi$ -function factor of the spherical harmonic gives  $e^{i(m\phi - \omega_n t)}$  for both the electron and the "trapped photon" function. The

photon is "glued" to the inner orbitsphere surface and the outer nuclear surface as photon source charge-density with a radial electric field.

From the application of the nonradiative boundary condition, the instability of excited states as well as the stability of the "ground" state arise naturally in the Mills theory as derived in Stability of Atoms and Hydrinos Section [2]. In addition to the above known states of hydrogen (Eq. (1), the theory predicts the existence of a previously unknown form of matter: hydrogen atoms and molecules having electrons of lower energy than the conventional "ground" state, called *hydrinos* and *dihydrinos*, respectively, where each energy level corresponds to a fractional quantum number.

The central field of the proton corresponds to integer one charge. Excited states comprise an electron with a trapped photon. In all energy states of hydrogen, the photon has an electric field which superposes with the field of the proton. In the  $n=1$  state, the sum is one, and the sum is zero in the ionized state. In an excited state, the sum is a fraction of one (i.e. between zero and one). Derivations from first principles given by Mills demonstrate that each "allowed" fraction corresponding to an excited state is  $\frac{1}{\text{integer}}$ . The relationship between the electric field equation and the "trapped photon" source charge-density function is given by Maxwell's equation in two dimensions.

$$\mathbf{n} \cdot (\mathbf{E}_1 - \mathbf{E}_2) = \frac{\sigma}{\epsilon_0} \quad (57)$$

where  $\mathbf{n}$  is the radial normal unit vector,  $\mathbf{E}_1 = 0$  ( $\mathbf{E}_1$  is the electric field outside of the orbitsphere),  $\mathbf{E}_2$  is given by the total electric field at  $r_n = na_H$ , and  $\sigma$  is the surface charge-density. The electric field of an excited state is fractional; therefore, the source charge function is fractional. It is well known that fractional charge is not "allowed". The reason is that fractional charge typically corresponds to a radiative current density function. The excited states of the hydrogen atom are examples. They are radiative; consequently, they are not stable. Thus, an excited electron decays to the first nonradiative state corresponding to an integer field,  $n=1$  (i.e. a field of integer one times the central field of the proton).

Equally valid from first principles are electronic states where the

magnitude of the sum of the electric field of the photon and the proton central field are an integer greater than one times the central field of the proton. These states are nonradiative. A catalyst can effect a transition between these states via a nonradiative energy transfer. Substantial experimental evidence exists that supports the existence of this novel hydrogen chemistry and its applications [27-62] which was missed entirely due to the erroneous concept of the hydrogen atom "ground state" based on the Schrödinger equation. An analysis of the shortcomings of the Schrödinger equation are given in the Appendix and in a paper by Mills [7]. The success of the classical theory of Mills is demonstrated in a recent presentation and recent publications [59-62].

## REGARDING THE FREE ELECTRON

Contrary to PZ's statements wherein he creates a straw man to knock down, the electron spin of the free electron is NOT required to be in the direction of propagation and are not required to be polarized. It is also remarkable that PZ claims that my solution for high energy scattering is flawed since I haven't presented it yet. I have presented the solution for elastic scattering of 500 eV electrons from helium atoms which is in remarkable agreement with published data; whereas it is acknowledged by the authors that QM utterly fails at small scattering angles. See Chp 8 of R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, [www.blacklightpower.com](http://www.blacklightpower.com). Furthermore, the QM high energy scattering theories which PZ claims are so successful are not based on first principles, but are merely curve fitting routines.

On page-158. appears:

Consider the case where a magnetic field is applied to the free electron. The energy of interaction of the magnetic moment of a Bohr magneton of the free electron with the applied magnetic field is minimized. The  $z'$ -axis (the former  $z$ -axis before the application of the magnetic field) of the free electron precesses parallel or antiparallel about the direction of the applied field, the  $z$ -axis called the spin axis now defined by the applied magnetic field. The center of mass of the electron propagates at the original constant velocity  $v_z$  in Eq. (3.2). The precessing free electron comprising a two dimensional disk rotates time harmonically about the  $x'$ -axis and by

the same angle,  $\theta$ , at any time point, about the  $y'$ -axis (the primed axis refers to the coordinate system of the free electron where the two dimensional disk lies in each new  $x'y'(\rho)$ -plane corresponding to each new set of axes established by rotations about the  $x'$  and  $y'$  axes) over the continuous angular range,

$$-\pi/2 \leq \theta \leq \pi/2 \quad \left(-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}\right).$$

Of course, quantum mechanics does not offer a solution to the free electron except for a contrived plane wave to explain electron scattering from atoms which utterly fails at small scattering angles as pointed out in my prior posts. Furthermore, the plane wave free electron of QM is not internally consistent:

- The Schrodinger equation predicts that each of the functions that corresponds to a highly excited state electron is not integrable and can not be normalized; thus, each is infinite.

- The Schrodinger equation predicts that the ionized electron is sinusoidal over all space and can not be normalized; thus, it is infinite.

The prediction of PZ based on the QM model of the free electron gives an infinite de Broglie electron wavelength and is inconsistent with the data of free electrons in superfluid helium as shown in my previous post:

Peter Zimmerman wrote:

> +++++ The electron radius cannot possibly depend upon the electron's  
> velocity, since an unaccelerated e- doesn't know what its velocity is.  
> This is simple special relativity. For the electron, the logical frame  
to  
> be in is its own rest frame. Thus, its radius cannot be a function of  
its  
> velocity, AND it cannot be two dimensional, nor even asymmetric in  
its own  
> rest frame because there is nothing in the frame to use to define  
the  
> vector. If it cannot be 2-d  
> or asymmetric 3-d in its rest frame, the only logical shape for it is a  
> sphere or a point. But since an extended electron would have  
experimental

> consequences observable at very low energies (as well as very high  
> energies), and since those consequences are never observed, then in  
its  
> own rest frame the electron can only be a point.

Robin van Spaandonk wrote:

>> Good point! This is one of the points that I made in my earlier  
post:  
>> <http://groups.yahoo.com/group/hydrino/message/2576>. The  
electron velocity  
>> in Eq. 3.24 is given in \*the inertial frame of the proton\*. So, at  
least,  
>> we can do away with an absolute reference frame. However, this  
is obviously  
>> problematic when there is no proton in the system of question. I  
think we  
>> need some explanation from Mills on this.

Peter Zimmerman wrote:

> +++++ The "inertial frame of the proton" makes no sense at all as a  
> definition. It wholly fails in any experiment using storage rings,  
> waveguides, etc.

The experimentally demonstrated de Broglie relationship is that the electron wavelength is inversely proportional to the electron's momentum relative to an inertial frame that is not the electron's frame since in this frame the electron is not moving. This case would imply an infinite de Broglie wavelength. CQM gives two Pi times the radius of the electron is the de Broglie wavelength [ref. 1 Electron in Free Space section]. The charge and current equations of the free electron match the experiments performed on the electron including positron-electron scattering [2-3], Stern Gerlach experiment, Davison Germer experiment, wave particle duality aspects, and scattering from atoms considering the nature of atomic electrons.

Your assertion is contradictory of experiments such as scattering experiments and the Davison Germer experiment. Furthermore, the universe is electrically neutral and contains no antimatter according to the particle production equation [(Eq. (23.172)) of ref. 1] of the contracting phase of the oscillatory universe. Particle production proceeds through a neutron pathway that gives the number of

electrons of the universe equal to the number of protons. The wavelength and the radius of the electron must depend on the velocity relative to the proton's inertial frame in order that relativistic invariance of charge holds and the universe is electrically neutral.

Quantum mechanics fails in these aspects. In fact, QM permits charged particles production including antimatter particles from a perfect vacuum (e.g. the experimentally not observed Hawking radiation). Furthermore, the point electron has infinite energy in its electric and magnetic fields, it is radiative in any bound state, it is not consistent with scattering experiments of free electrons and is inconsistent with scattering of electrons from atomic electrons. In the latter case, point atomic electrons can not give rise to neutral scattering and even while violating physics by requiring that the electron is everywhere at once or travels faster than the speed of light, QM utterly fails to match the results of elastic scattering from helium atoms.

The Schrodinger equation interpreted as a probability wave of a point particle can not explain that the hydrogen atom is neutral. For example, it can not explain neutral scattering of electrons or light from hydrogen. The point particles must align perfectly; otherwise Rutherford scattering would be observed. In this case, the Uncertainty Principle is violated. The Born interpretation can only be valid if the speed of the electron is equal to infinity. (The electron must be in all positions weighted by the probability density function during the time of the scattering event). The correct aperture function for the Born interpretation is a Dirac delta function having a Fourier transform of a constant divided by  $s^2$  which is equivalent to the case of the point nucleus (Rutherford Equation). The Born interpretation must be rejected because the electron velocity can not exceed the speed of light without violating Special Relativity.

The elastic scattering of electrons from an atomic beam of helium atoms is given in the DERIVATION OF ELECTRON SCATTERING BY HELIUM section [1]. The equation of elastic scattering of 500 eV electrons from helium atoms is solved as the Fraunhofer pattern in the far field. The closed form equation of the free electron from the Electron in Free Space section is used with the closed form equation of the helium atom from the Two Electron Atoms section [1]. This is the case of Z in the closed form equation solved for all two electron atoms. The calculation is a Fourier optic type which reduces to a

spherical lens calculation. The math is well known. The resultant closed form equation has no adjustable parameters. The prediction identically and continuously matches the experimental scattering data [4]. In the case of the quantum mechanical calculation, the calculation is on a point-by point basis without regard to internal consistence or physical laws, is unstable--blows up to positive or negative infinity based on round-off error, contains adjustable parameters, and in the words of the authors, "at smaller scattering angles; however, the Born approximation calculation fails utterly, the experimental curve rising much more steeply than the theoretical" [5].

1. R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, [www.blacklightpower.com](http://www.blacklightpower.com).
2. Gribbin, J., New Scientist, January, 25, (1997), p. 15.
3. Levine, I., et al., Physical Review Letters, Vol. 78., No. 3, (1997), pp. 424-427.
4. Bromberg, P. J., "Absolute differential cross sections of elastically scattered electrons. I. He, N<sub>2</sub>, and CO at 500 eV", The Journal of Chemical Physics, Vol. 50, No. 9, (1969), pp. 3906-3921; Geiger, J., "Elastische und unelastische streuung von elektronen an gasen", Zeitschrift fur Physik, Vol. 175, (1963), pp. 530-542; Peixoto, E. M., Bunge, C. F., Bonham, R. A., "Elastic and inelastic scattering by He and Ne atoms in their ground states", Physical Review, Vol. 181, (1969), pp. 322-328.
5. Bromberg, P. J., "Absolute differential cross sections of elastically scattered electrons. I. He, N<sub>2</sub>, and CO at 500 eV", The Journal of Chemical Physics, Vol. 50, No. 9, (1969), pp. 3906-3921

The point electron also fails to match experimental data described in 20 points in my papers given below and is further disproved by the well established data of the mobility of electrons in superfluid helium:

R. Mills, "The Hydrogen Atom Revisited", Int. J. of Hydrogen Energy, Vol. 25, Issue 12, December, (2000), pp. 1171-1183.

Several myths about quantum mechanics exist due to a loss of awareness of its details since its inception in the beginning of the last century or based on recent experimental evidence. It is taught in textbooks that atomic hydrogen cannot go below the ground state. Atomic hydrogen having an experimental ground state of 13.6 eV can only exist in a vacuum or in isolation, and atomic hydrogen

cannot go below this ground state in isolation. However, there is no known composition of matter containing hydrogen in the ground state of 13.6 eV. It is a myth that hydrogen has a theoretical ground state based on first principles. Historically there were many directions in which to proceed to solve a wave equation for hydrogen. The Schrodinger equation gives the observed spontaneously radiative states and the nonradiative energy level of atomic hydrogen. On this basis alone, it is justified despite its inconsistency with physical laws as well as with many experiments. A solution compatible with first principles and having first principles as the basis of quantization was never found. Scattering results required the solution to be interpreted as probability waves that give rise to the uncertainty principle which in turn forms the basis of the wave particle duality. The correspondence principle predicts that quantum predictions must approach classical predictions on a large scale. However, recent data has shown that the Heisenberg uncertainty principle as the basis of the wave particle duality and the correspondence principle taught in textbooks are experimentally incorrect. Recently, a reconsideration of the postulates of quantum mechanics, has given rise to a closed form solution of a Schrodinger-like wave equation based on first principles. Hydrogen at predicted lower energy levels has been identified in the extreme ultraviolet emission spectrum from interstellar medium. In addition, new compositions of matter containing hydrogen at predicted lower energy levels have recently been observed in the laboratory, which energy levels are achieved using the novel catalysts.

R. Mills, The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, submitted.

The Schrodinger equation was originally postulated in 1926 as having a solution of the one electron atom. It gives the principal energy levels of the hydrogen atom as eigenvalues of eigenfunction solutions of the Laguerre differential equation. But, as the principal quantum number  $n \gg 1$ , the eigenfunctions become nonsensical. Despite its wide acceptance, on deeper inspection, the Schrodinger solution is plagued with many failings as well as difficulties in terms of a physical interpretation that have caused it to remain controversial since its inception. Only the one electron atom may be solved without approximations, but it fails to predict electron spin and leads to models with nonsensical consequences such as negative energy states of the vacuum, infinities, and negative kinetic energy.



In addition to many predictions which simply do not agree with observations, the Schrodinger equation predicts noncausality, nonlocality, spook actions at a distance or quantum telepathy, perpetual motion, and many internal inconsistencies where contradicting statements have to be taken true simultaneously. Recently, the behavior of free electrons in superfluid helium has again forced the issue of the meaning of the wavefunction. Electrons form bubbles in superfluid helium which reveal that the electron is real and that a physical interpretation of the wavefunction is necessary. Furthermore, when irradiated with light of energy of about a 0.5 to several electron volts [1], the electrons carry current at different rates as if they exist with different sizes. It has been proposed that the behavior of free electrons in superfluid helium can be explained in terms of the electron breaking into pieces at superfluid helium temperatures [1]. Yet, the electron has proven to be indivisible even under particle accelerator collisions at 90 GeV (LEP II). The nature of the wavefunction must now be addressed. It is time for the physical rather than the mathematical nature of the wavefunction to be determined. A theory of classical quantum mechanics (CQM) was derived from first principles by Mills [2] that successfully applies physical laws on all scales. Using the classical wave equation with the constraint of nonradiation based on Maxwell's equations, CQM gives closed form physical solutions for the electron in atoms, the free electron, and the free electron in superfluid helium. The prediction of fractional principal quantum energy states of the electron in liquid helium match the photoconductivity and mobility observations without requiring that the electron is divisible.

Randy Mills

High energy scattering experiments confirm the CQM picture of the free electron. This issue has also been dealt with previously:

Things that Go Bump in the Night

Peter Zimmerman wrote:

>I have received the KEK paper (Levine, et al., PRL 78, No.  
>3, 20 Jan 1997, pp 424-427) which Mills has frequently used  
>to say that scientists have now proven that the electron  
>behaves like a distributed object. I have had time to go

>through the paper a couple of times, and I must say that I  
>am wholly unable to fathom how Mills extracted that notion  
>from the measurement of the electromagnetic coupling at  
>large values of the 4-momentum transfer squared ( $Q^2$ ).

>  
>It is true that the EM coupling constant increases slightly  
>above  $1/137$  as  $Q^2$  increases (to around  $1/128$ ), but that is  
>exactly as would be expected based on the standard theory of  
>a point electron. I grant that Mills will reject this  
>reading of the paper, because he doesn't believe in Feynman  
>diagrams, virtual photons, virtual particles, vacuum  
>polarization, etc. But it is perfectly in accord with  
>theory and with other measurements of the electro-weak force  
>increasing at large  $Q^2$  and the strong force decreasing.

>  
>If Mills rejects the plain language interpretation of the  
>paper, that is his choice. However, since nothing of the  
>kind was shown, it is incorrect of him to say that it  
>demonstrates that "the charge of a free electron increases  
>towards the particle's core and is symmetric in  $\phi$ ." He  
>should not put words into the mouths of the KEK researchers.

>  
>I will not make a copy of the paper available for posting to  
>HSG's site because of the copyright issue. The paper may be  
>downloaded from the APS only on payment of a fee, and I  
>think that should extend to downloading from HSG.

>From Gribbin, J., New Scientist, January, 25, (1997), p. 15.

"An electron may be more than a simple blob of charge, contrary to conventional theory. Research by a team of Japanese and American physicists suggest that the electromagnetic charge in an electron increases towards the particle's central core.....The true value of the electromagnetic charge near the center was far greater than at the edge. The charge on the electron appears to be evenly distributed around its surface..."

Quantum mechanical interpretations of this and other data discussed  
infra. are:

1.) virtual particles surround the electron and shield the charge less  
effectively as the electron's center is approached,

- 2.) spooky action at a distance,
- 3.) a  $9\text{Be}^+$  ion may be in two separate locations at once,
- 4.) supercurrent may go in both directions at once,
- 5.) perpetual motion is predicted.

Then there is reality:

- 1.) the electron charge density is greatest in center,
- 2.) photon momentum is conserved on a photon by photon basis rather than statistically as predicted by quantum mechanics,
- 3.) the fluorescence emission spectrum of a Penning trapped  $9\text{Be}^+$  ion shows interference peaks due to coupling between oscillator modes and a Stern Gerlach transition,
- 4.) the energy difference of a superconducting loop observed by Friedman et al. matches the energy corresponding to the flux linkage of the magnetic flux quantum by the ensemble of superconducting electrons in their entirety with a reversal of the corresponding macroscopic current,
- 5.) perpetual motion is not permitted or observed.

These examples are given in the Wave-Particle Duality section of R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, April 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, [www.blacklightpower.com](http://www.blacklightpower.com).

and

R. Mills, The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory, Int. J. Hydrogen Energy, in press.

The Heisenberg Uncertainty Principle Predicts Nonlocality, Noncausality, Spooky Actions at a Distance, and Perpetual Motion which can be Shown to be Experimentally Incorrect.

Flawed Interpretation of the Results of the Aspect Experiment--  
There Is No Spooky Action at a Distance

Bell [121] showed that in a Gedanken experiment of Bohm [122] (a variant of that of EPR) no local hidden-variable theory can reproduce all of the statistical predictions of quantum mechanics. Thus, a paradox arises from Einstein's conviction that quantum-mechanical predictions concerning spatially separated systems are incompatible

with his condition for locality unless hidden variables exist. Bell's theorem provides a decisive test of the family of local hidden-variable theories (LHVT). In a classic experiment involving measurement of coincident photons at spatially separated detectors, Aspect [123] showed that local hidden-variable theories are inconsistent with the experimental results. Although Aspect's results are touted as a triumph of the predictions of quantum mechanics, the correct coincidence rate of detection of photons emitted from a doubly excited state of calcium requires that the z component of the angular momentum is conserved on a photon pair basis. As a consequence, a paradox arises between the deterministic conservation of angular momentum and the Heisenberg uncertainty principle. The prediction derived from the quantum nature of the electromagnetic fields for a single photon is inconsistent with Aspect's results, and Bell's theorem also disproves quantum mechanics. Furthermore, the results of Aspect's experiment are predicted by Mills' theory wherein locality and causality hold. Mills derives the predicted coincidence rate based on first principles [124]. The predicted rate identically matches the observed rate.

The Aspect experiment is a test of locality and local hidden variable theories. The Aspect experiment is also a test of quantum mechanics and the HUP. In one design of the experiment, photons are incident to a beam splitter which causes each photon to be split into two that travel along opposite paths to separate detectors. The separate detectors measure the polarization of the arriving photons. By using synchronous detection, photons of a pair may be later compared. The data indicate a random pattern at each detector individually; however, when photons are matched up as pairs, an essentially perfect correlation exists. The quantum mechanical explanation is that before the photon was split its state of polarization was indeterminate. It possessed an infinite number of states in superposition. Then when one element of the pair was detected information traveled instantaneously (infinitely faster than the speed of light--otherwise known as a spooky action at a distance) to cause the other photon to have a matching polarization. In quantum mechanical terms, the states were entangled, and measurement of one photon caused the other photon's wavefunction to collapse into the matching state.

The correct explanation is that each photon entering the beam splitter originally had a determined state, and angular momentum was conserved on a photon by photon basis at the splitter. Thus,

each photon of a pair had a matching polarization before it hit the detector. Locality and cause and effect hold. There is no spooky action at a distance. This experiment actually disproves quantum mechanics. It also disproves local hidden variable theories. The data of the Aspect experiment matches a classical derivation, not a quantum mechanical one.

Everyday observation demonstrates that causality and locality always hold. Bell's theorem postulates that a statistical correlation of  $A(a)$  and  $B(b)$  is due to information carried by and localized within each photon, and that at some time in the past the photons constituting one pair were in contact and in communication regarding this information. This is the case in many everyday experiences such as transmission, processing, and reception of signals in microelectronics devices. Locality and causality always hold. They hold on the scale of the universe also. But, according to the Big Bang theory of quantum mechanics all photons were at one time in contact; thus, no locality or causality should be observed at all. This is nonsense. The results of the Aspect experiment support the EPR paradox that QM does not describe physical reality. There is a mistake in the derivation of the analysis of the data from Aspect's experiment [125-126].

Bell's theorem is just an inequality relationship between ARBITRARY probability density functions with certain assumptions about independence, expectation value equal to one, etc. wherein an additional probability distribution function is introduced which may represent local hidden variables or something else for that matter. And, the initial functions may correspond to quantum mechanical statistics or something else for that matter. Standard probability rules are accepted such as the probability of two independent events occurring simultaneously is the product of their independent probabilities. What is calculated and plugged into the formula for the functions and whether the substitutions are valid are the issues that determine what Bell's inequality tests when compared with data. Historically, Bell's inequality is a simple proof of statistical inequalities of expectation values of observables given that quantum statistics is correct and that the physical system possesses "hidden variables". However, if deterministic statistics are actually calculated and quantum statistics is equivalent to deterministic statistics (e.g. detection of a wave at an inefficient detector) but possesses further statistics based on the probability nature of the theory (statistical conservation of photon angular momentum), then Bell's inequality is

actually testing determinism versus quantum theory when compared to the data.

Rather than demonstrating that QM does not give us all of the information about the physical world, the data is consistent with the result that QM does not describe the physical world, and that deterministic physics does. A deterministic theory is not required to possess local hidden variables. Maxwell's equations is a deterministic theory. It does not have local hidden variables (LHV). There is no corresponding statistical distribution function. Bell's theorem is a simple proof of statistical inequalities of expectation values of observables given that "QUANTUM" statistics is correct and that the physical system possesses "hidden variables" corresponding to an additional statistical distribution function. What was actually derived to explain the results of the Aspect experiment [123] was a classical calculation of the detection of an extended particle, the polarized photon, at an inefficient detector wherein determinism holds with respect to conservation of angular momentum [125-126]. Thus, the statistics defined as "QUANTUM" was actually deterministic. (The derivation is given by Mills [124]). Furthermore, in actuality, quantum statistics must also possess other statistical distribution functions corresponding to the probability nature of the theory such as a statistical distribution for the z component of angular momentum which is conserved statistically as the number of photons goes to infinity. Thus, the real quantum mechanics statistics corresponds to a local hidden variable theory (LHVT) with respect to the definitions of the arbitrary probability distribution functions in Bell's inequality. Aspect recorded the expectation value of the coincidence rate at separated randomly oriented inefficient polarization analyzers for pairs of photons emitted from a doubly excited state calcium atom. The data showed a violation of Bell's inequality. This proves determinism and the real QM statistics fails the test. Furthermore, the observed coincidence count rate of Aspect [123] is equal to that predicted classically from the statistics of measurement at an inefficient detector only. The additional finite distribution function required in the case of quantum mechanics and QED results in incorrect predictions. There is no spooky action at a distance.

The Aspect experiment shows that momentum is conserved on a photon by photon basis, not statistically as predicted by the HUP. Similar experiments regarding tests of entanglement predicted by the HUP are shown to be consistent with first principle predictions

and reveal flaws in the interpretations based on the HUP. The HUP implies nonlocality, noncausality, and spooky actions at a distance which can be shown to be experimentally incorrect.

### Flawed Interpretation of the Results on a Single $9\text{Be}^+$ Ion in a Trap in a Continuous Stern-Gerlach Experiment--An Ion Can Not Be at Two Places at the Same Time

There is a mistake in the analysis of the data from Monroe et al. [127]. Their interpretation that the same beryllium ion was observed to be at widely separated points at the same time is absolute nonsense. Their experimental results show that locality and causality hold [128].

A report in New York Times [129] entitled "Physicists Put Atom in 2 Places at Once" states, "a team of physicists has proved that an entire atom can simultaneously exist in two widely separated places". The article further states, "In the quantum "microscale" world, objects can tunnel magically through impenetrable barriers. A single object can exist in a multiplicity of forms and places. In principle, two quantum-mechanically "entangled" objects can respond instantly to each other's experiences, even when the two objects are at the opposite ends of the universe". Experimentally, interference patterns were observed by Monroe et al. [127] for a single  $9\text{Be}^+$  ion in a trap in a continuous Stern-Gerlach experiment. Monroe's interpretation of the experimental observation was that the ion wave-function interfered with itself wherein the ion was at two separate places at the same time corresponding to a wave function state called a "Schrodinger cat" state [127, 129-130]. According to Monroe et al.,

"A "Schrodinger cat"-like state of matter was generated at the single atom level. A trapped  $9\text{Be}^+$  ion was laser-cooled to the zero-point energy and then prepared in a superposition of spatially separated coherent oscillator states. This state was created by application of a sequence of laser pulses, which entangles internal (electronic) and external (motional) states of the ion. The "Schrodinger cat" superposition was verified by detection of the quantum mechanical interference between the localized wave packets. This mesoscopic system may provide insight into the fuzzy boundary between the classical and quantum worlds by allowing controlled studies of quantum measurement and quantum decoherence."

The "Schrodinger cat" state analysis relies on the postulate that the

Pauli Exclusion Principle applies to Rabi states wherein a rotation of the magnetic moment of the unpaired electron of an RF-trapped ion is represented by a linear combination of spin  $1/2$  and spin  $-1/2$  states. Three steps of rotation of the spin magnetic moment by a time harmonic field provided by pairs of copropagating off-resonant laser beams which drove two-photon-stimulated Raman magnetic resonance transitions were each separated by displacement laser pulses which excited a resonant translational harmonic oscillator level of the trapped ion by coupling only with the  $+1/2$  state. According to Monroe, "this selectivity of the displacement force provides quantum entanglement of the internal state with the external motional state. Although the motional state can be thought of as nearly classical, its entanglement with the internal atomic quantum levels precludes any type of semiclassical analysis". The interference was detected by exciting a fluorescent transition which only appreciatively coupled to the  $-1/2$  state. Thus, the fluorescence reading was proportional to the probability  $P(-)$  the ion was in state  $-1/2$ . The "Schrodinger cat" superposition was supposedly verified by detection of the quantum mechanical interference between the localized wave packets.

However, the interference arises not from the existence of the ion at two places at once. The positively charged ion was excited to a time harmonic translational energy state, and the spin quantization axis was defined by an applied 0.3 mT magnetostatic field at an angle of  $\pi/4$  with respect to the x-axis of the RF-trap. The frequency of the energy to "flip" the spin state was equivalent to the projection of that of the translational harmonic oscillator onto the spin axis

$$\omega/2\pi \cos^2\pi/4 = 11.2 \text{ MHz} (0.5 \text{ MHz}) \approx E \text{ spin}/h \quad (132)$$

given by Eqs. (37.45-37.48) of Mills [128]. Thus, interference occurred between the Stern-Gerlach transition and the synchrotron radiation corresponding to the charged harmonic oscillator. Since the displacement beams affected only motion correlated with the  $+1/2$  state, a rotation of the magnetic moment such that  $\Delta \neq 0$  with application of the displacement beams gives rise to a phase shift of the interference pattern. The closed form calculation is given in Mills [128].

Flawed Interpretation of the Results of Experiments on a Small SQUID Coupled to a Biased Large Superconducting Current Loop--A Superconducting Current Can Not Flow in Opposite Directions at the



## Same Time

There is a mistake in the analysis of the data from Friedman et al. [131]. Their interpretation that a superconducting current loop can exist as a superposition of contradictory states at the same time is absolute nonsense. It is shown by Mills [132] that their experimental results are consistent with locality and causality.

A recent report in The New York Times [133] entitled "Here, There and Everywhere: A Quantum State of Mind" states, "Physicists at Delft University of Technology have put a 5-micrometer-wide loop of superconducting wire into a "quantum superposition" of two contradictory possibilities: in one, the current flows clockwise; in the other, current flows counterclockwise." The article further states, "In the realm of atoms and smaller particles, objects exist not so much as objects as mists of possibilities being here there and everywhere at the same time-and then someone looks and the possibilities suddenly collapse into definite locations." The experiment was a simplified version of the concept of Schrödinger's cat. In 1935, Schrödinger [134] attempted to demonstrate the limitations of quantum mechanics using a thought experiment in which a cat is put in a quantum superposition of alive and dead states.

Instead of a cat, Friedman et al. [131] used a small square loop of superconducting wire linked to a SQUID (Superconducting Quantum Interference Device). A SQUID comprises a superconducting loop with a Josephson junction, a weak link that causes magnetic flux to be linked in integer units of the magnetic flux quantum. When the loop is placed in an external magnetic field, the loop spontaneously sets up an electrical current to cancel the field or generate an additional magnetic field, adjusting the magnetic field to a unit of the magnetic-flux quantum, one of the allowed values. In the experiment of Friedman et al., the loop was placed in a magnetic field equal to one half of the first allowed value, a magnetic flux quantum. Thus, the loop could set up either a current to raise the field strength to the first allowed value, or with equal probability, a current of equal magnitude flowing in the opposite direction to cancel out the external field. A pulse of microwaves was applied at the frequency to cause a transition of the magnetic moment of the current loop as an entirety. The absorption of microwaves caused the magnetic state of the SQUID to change and the current to reverse its direction.

Experimentally, a measurement always gave one of the two possible

answers, clockwise or counterclockwise, never a zero cancellation. A difference in energy at which the flip transition occurred between the two possibilities was detected by a group led by J. Lukens and J. Friedman at the State University of New York (SUNY). A simple explanation was that the microwaves simply flipped the current direction which had an energy bias in one direction versus the opposite based on the corresponding presence or absence of a magnetic flux quantum within the SQUID. Rather, they interpreted the results as experimental evidence that a SQUID can be put into a superposition of two magnetic flux states: one corresponding to a few microamperes of current flowing clockwise and the other corresponding to the same amount of current flowing anticlockwise. "Just as the cat is neither alive nor dead but a ghostly mix of the two possibilities, the current flows neither clockwise or counterclockwise, but is a mix of the two possibilities [133]." According to Friedman, "we can have two of these macroscopically well-defined states at the same time. Which is something of an affront to our classical intuitions about the world [133]."

Current running in both directions simultaneously is nonsensical. Current is a vector and must have only one direction. The energy difference observed by Friedman et al. can be explained CLASSICALLY. The experimental apparatus comprised a small SQUID coupled to a large current loop. A second SQUID magnetometer read the flux state of the first sample SQUID. The energy difference was not due to superposition of flux states. Rather, it was due to the nature of the electron which carries the superconducting current and links flux in units of the magnetic flux quantum. Consequently, the sample SQUID linked zero or one magnetic flux quantum. When excited by electromagnetic radiation of a resonant frequency, individual electrons undergo a spin-flip or Stern Gerlach transition corresponding to a reversal of the electron magnetic moment, angular moment, and current. The Stern Gerlach transition energies of electrons superimpose. The energy difference observed by Friedman et al. matches the energy corresponding to the flux linkage of the magnetic flux quantum by the ensemble of superconducting electrons in their entirety with a reversal of the corresponding macroscopic current. The linkage was caused by high power microwave excitation of a Stern Gerlach transition of the magnetically biased loop which caused a concomitant change in the flux state of the separately magnetically biased sample SQUID. In this case, the microwave frequency was kept constant, and the bias flux of the loop was scanned at a fixed magnetic bias of the sample

SQUID until the resonance with the superposition of the Stern Gerlach transitions of the superconducting electrons in their entirety was achieved.

### Flawed Prediction of Perpetual Motion by the Heisenberg Uncertainty Principle

Another consequence of HUP wherein entanglement of states is implicit is the prediction of perpetual motion. Schewe and Stein report on the work of Allahverdyan and Nieuwenhuizen [135]:

"Armen Allahverdyan of, CEA Saclay (France)/University of Amsterdam (Netherlands)/Yerevan Physics Institute (Armenia), aarmen@spht.saclay.cea.fr, and Theo Nieuwenhuizen of the University of Amsterdam (nieuwenh@wins.uva.nl, 011-31-20-525-6332) [136] suggest that a quantum particle (such as an electron) interacting strongly with a reservoir of particles may violate the Clausius inequality--one formulation of the second law of thermodynamics, which states that it is impossible to do work without losing heat. What the researchers term "appalling behavior" can be traced to the quantum mechanical property of entanglement, in which a quantum particle (such as an electron) is so strongly interlinked with another particle or group of particles that the resulting behavior cannot be treated by standard thermodynamic approaches. In this paper, the Amsterdam scientists study the entanglement of a particle with a "quantum thermal bath," a reservoir of particles with which the first particle can exchange energy and momentum. According to the researchers, entanglement prevents the quantum bath from observing the normal requirements for a heat bath. Therefore, thermodynamics simply cannot say anything useful about the system.

Standard thermodynamics dictates that the bath be in thermal equilibrium and not interact strongly with an external object. To the contrary, the bath strongly interacts with something external to it (the entangled particle) and it cannot reach equilibrium, since it constantly exchanges energy and momentum with the particle. At low temperatures where entanglement could be easily preserved, the researchers state that this system can apparently violate the Clausius inequality--in which the heat gained by the particle must be less than or equal to the temperature multiplied by the change in its entropy (or disorder). Near absolute zero temperatures, a situation which would ordinarily require the particle to lose heat, the

researchers show that the particle could gain heat, by the Clausius relation. According to this scenario, applying a cyclic parameter such a periodically varying external magnetic field can cause the entangled particle to extract work from the bath--something forbidden in a classical system. Further, the researchers say that this phenomenon could be said to constitute a perpetual motion machine of the second kind."

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Randy Mills

Except for a trite reference in his last post to see Bohm's implausible interpretation of QM, none of these issues were ever dealt with by PZ or any of the quantum aficionados on this group or now gone from it which is the basis of my previous post:

### Professionalism

Starting with a post by Aaron Barth and followed by numerous posts by Aaron Barth and Peter Zimmerman, I have been accused of citing astrophysical data which does not actually exist. In reality, Barth has referred to a different journal article and a different spectrum than that which I evaluated and cited. Other spectroscopists who participated in the data analysis or reviewed the data used the same spectrum which I cited rather than another. Whether Barth and Zimmerman's mistake occurred by carelessness or intentionally, I feel that it is only appropriate to restrict criticism to the actual citation rather than fabricate a rebuttal based on substitute data not originally cited. This also applies in the case on CQM. Criticism should only be based directly on my derivations and writings, rather than a misrepresentation. Zimmerman's statements that the spin vector "MUST" be in the direction of motion is but one example.

In addition, often rebuttals to the critics appear to fall on deaf ears, and the critics repeat the same phenomena (such as measurements to which QED is applied) even though careful derivations based on CQM that match the data exactly have been presented. For example, I have made numerous posts and cited my publications which clearly challenge the trappings of QM such as virtual particles surround the electron and shield the charge less effectively as the electron's center is approached, spooky action at a distance, a  $9\text{Be}^+$  ion may be in two separate locations at once, supercurrent may go in both directions at once, perpetual motion is predicted, probability waves, virtual particles, negative energy of the vacuum, polarization of the vacuum by virtual particles, renormalization, effective nuclear charge, ionic terms in the perturbation series, fermion propagators, virtual photon annihilation, virtual photon emission and reabsorption, virtual electron positron annihilation, photon propagators, plethora of

postulated super-symmetry virtual particles which make contributions such as smuon-neutralino and sneutrino-chargino loops, neutrino oscillation, worm holes, parallel universes, parallel mind universes, quantum telepathy, entanglement, spooky actions at a distance, dark energy, exotic particles comprising dark matter, the universe from nothing, big bang-inflation,-deceleration-reacceleration of the universe, and so on and so on. CQM explains the data based on reality versus fantastical interpretations of wave equation solutions.

What do the critics have to say about the real world explanations that have been provided? For example, what specifically is the QM answer to the 15 ion mobility peaks observed for electrons in super fluid helium? This data as well as a multitude of other fundamental experiments challenge the foundation of QM (See R. Mills, *The Nature of Free Electrons in Superfluid Helium--a Test of Quantum Mechanics and a Basis to Review its Foundations and Make a Comparison to Classical Theory*, Int. J. Hydrogen Energy, in press). A recent paper in peer review for three years [Laloë, F., "Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems", Am. J. Phys. 69 (6), June 2001, 655-701] similarly demonstrates that the foundations of QM are nonsensical. The abstract is given infra. Even QM aficionados do not believe that QM describes physical reality. I quote Fuchs and Peres, "Contrary to those desires, quantum theory does NOT describe physical reality." [C. A. Fuchs and A. Peres, "Quantum Theory Needs No "Interpretation", Physics Today, March (2000), p. 70].

In a recent communication to which I have responded [A. K. Vijn, "Hydrino atom: novel chemistry or invalid physics?", Int. J. of Hydrogen Energy, Vol. 26, (2000), p. 281], Vijn cites Robert Park's book, *Voodoo science* (Footnote 1), and presents the typical mantra: Mills' "state below the ground state [1-4] is, according to Park, a contradiction in terms like "south of the South Pole". It violates the foundations of quantum mechanics: the exact prediction of the hydrogen spectrum was one of the first great triumphs of quantum theory-- the theory accounts perfectly for every spectral line and there is no line corresponding to a "hydrino" state (emphasis added starting at "there") (Footnote 2). Vijn ends with "the foundations of quantum theory are safe". I see this defensive mentality of treating any theory as sacrosanct as the root of why QM and technology predicted by QM has been a dismal failure for the past several decades. QM is stifling innovation and the progress of science. And,

there is an intolerance to new ideas which are attacked without regard to professionalism in an organized pack-like manner. I am not the only one who is concerned about the future of science. Consider Weinstein's letter to Chemical and Engineering News [A. Weinstein, C&EN, May 7, (1990)] given below. What has changed in the past decade since Weinstein's letter was published?

ABSTRACT of Laloë, F., Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems, Am. J. Phys. 69 (6), June 2001, 655-701.

Do we really understand quantum mechanics? Strange correlations, paradoxes, and theorems

This article presents a general discussion of several aspects of our present understanding of quantum mechanics. The emphasis is put on the very special correlations that this theory makes possible: They are forbidden by very general arguments based on realism and local causality. In fact, these correlations are completely impossible in any circumstance, except for very special situations designed by physicists especially to observe these purely quantum effects. Another general point that is emphasized is the necessity for the theory to predict the emergence of a single result in a single realization of an experiment. For this purpose, orthodox quantum mechanics introduces a special postulate: the reduction of the state vector, which comes in addition to the Schrödinger evolution postulate. Nevertheless, the presence in parallel of two evolution processes of the same object (the state vector) may be a potential source for conflicts; various attitudes that are possible to avoid this problem are discussed in this text. After a brief historical introduction, recalling how the very special status of the state vector has emerged in quantum mechanics, various conceptual difficulties are introduced and discussed. The Einstein-Podolsky-Rosen (EPR) theorem is presented with the help of a botanical parable, in a way that emphasizes how deeply the EPR reasoning is rooted into what is often called "scientific method." In another section the Greenberger-Horne-Zeilinger argument, the Hardy impossibilities, as well as Bell-Kochen-Specker theorem are introduced in simple terms. The final two sections attempt to give a summary of the present situation: One section discusses nonlocality and entanglement as we see it presently, with brief mention of recent experiments; the last section contains a (nonexhaustive) list of various attitudes that are found among physicists, and that are helpful to alleviate the

conceptual difficulties of quantum mechanics.

C&EN Correspondence by A. Weinstein

### Quantum theory

Sir: With regard to Richard C. Henry's review of the book, "The Tenth Dimension" (C&EN, Jan 22, page 27), I, for one, tired of being bullied by physicist bearing the red herring of quantum theory—a failed theory if there ever was one. As was remarked by more than one chemist in these pages over the past two or three decades, literally man-centuries of work have been wasted trying to synthesize compounds that the quantum theory unequivocally states should be stable, only to find that the compounds do not exist in any form whatsoever.

Of course, the physics community itself is deeply divided over the validity of the Schrödinger equation with about half (as best I can judge) not believing that the equation is a correct, let alone a complete, representation of reality. Einstein was only the most famous of the physicists who dissented from the Schrödinger formulation—there are and were hordes of others. Louis de Broglie fought the theory through all the days of his life, though his famous equation was an integral part of its development.

As things have gone on through the years, the results have been an ever more bizarre progression of ideas and assertions that have finally culminated in what is simply solipsistic nihilism—nothing can exist except what I want to exist—as grotesque as it is absurd. The next time you watch your TV screen, just imagine that it isn't being lighted up by accelerated electrons at all, just by your own desire.

There is nothing at all wrong with the idea of an electron orbiting around a proton—this is exactly what Bohr used to develop his original ideas, in very close agreement with experiment, and based on the redoubtable Coulomb's law. Aside from leading to all sorts of impossible conundrums and paradoxes, Schrödinger's equation does not repeat not predict all four quantum numbers (it misses spin altogether), and succeeds in only a few very special cases in predicting anything at all that can be subject to precise measurement. For these and many other reasons (including the



destruction of the very logic of science itself), I repeat that legions of physicists have rejected the Schrödinger quantum formulation, believing at best that the correct and complete theory has yet to be worked out. (Score: a few select successes, and mountains of failures. Sensible theoretical chemists continue to shun quantum theory in droves.)

It is a shame that the educational experiences of most chemists do not permit them to evaluate, let alone see through, this welter of nonsense and confusion, and thus to send the infamous thing (quantum theory) back to its makers with an appropriate whack on its bedraggled tail. You can see the result of this hodgepodge in any introductory chemistry text that you care to open. (Pace Voltaire!)

Although history cannot be altered, future curricula can be adjusted to help prevent another similar fiasco from occurring. Nor at least try.

Allan Weinstein  
Lawrence, Kan.

Footnote 1. Vижh reference to Park's book is incorrect. These statements can be found on the APS website and Park writings in Forbes magazine. Explicitly from R. Park, "Mills calls it the most important discovery of all time, up there with fire. Could he be right? No." Forbes, May 15, 2000, p. 126:

"Think of an alarm clock that is completely unwound. A physicist would say the rundown clock is in its "ground state." You study the energy spectrum of a particular type of atom by looking at its spectrum--the specific wavelengths emitted as the atom's electrons cascade from an excited state to lower energy levels, ending with the ground state. The exact prediction of the hydrogen spectrum was one of the great triumphs of quantum theory. It is the platform on which our entire understanding of atomic physics is built. The theory accounts perfectly for every spectral line. There is no line corresponding to a "hydrino" state."

Footnote 2. Park is advised to review our 25 journal articles including: R. Mills, P. Ray, "Spectral Emission of Fractional Quantum Energy Levels of Atomic Hydrogen from a Helium-Hydrogen Plasma and the Implications for Dark Matter", Int. J. Hydrogen Energy, submitted; posted at [www.blacklightpower.com](http://www.blacklightpower.com).

Randy Mills

## **REGARDING THE GRAVITATIONAL MASS OF THE FREE ELECTRON AND PHOTON**

These issues were dealt with in my prior posts:

Only QM Gives Perpetual Motion

Peter Zimmerman wrote:

> +++ Nora Baron has identified the classic form a  
> a perpetual motion machine of the first kind (i.e. First Law  
> violator), and she has shown that if the gravitational mass  
> of the electron is time dependent (in this case because it  
> can go from bound to unbound) one can make a wheel turn  
> without other input of work -- and that the wheel has the  
> ability to do useful work without further input of work. Tom  
> Stolper said that there remained details to work out. Yes,  
> but those are 'practical' engineering difficulties rather  
> than conceptual barriers which would stand in the way of a  
> Gedankenexperiment working.  
>  
> As John Kassebaum pointed out, in the real world for such a  
> thing to be possible is absurd. Which is quite a blow to  
> the standard Mills version of the electron.

(The equations which are shown in the attachment are not shown below -- only the text. If problems are encountered in opening this document, contact [bstepien@blacklightpower.com](mailto:bstepien@blacklightpower.com) or BLP's IT manager may be contacted after 8/5 at [dreilly@blacklightpower.com](mailto:dreilly@blacklightpower.com).)

As shown in the attachment, the CQM theory of gravitation is consistent with first principle laws including conservation of energy with respect to gravitation of the free electron. Whereas, an inescapable consequence of the Heisenberg Uncertainty Principle is the prediction of an infinite cosmological constant and a perpetual motion machine of the first kind. Another consequence of the

Heisenberg Uncertainty Principle wherein entanglement of states is implicit is the prediction of a perpetual motion machine of the second kind. These and other nonsensical predictions of QM demonstrate that this theory is fatally flawed [Footnote 1].

#### Summary of Some Points Regarding the CQM Theory of Gravitation [1]:

- For or any kind of wave advancing with limiting velocity and capable of transmitting signals, the equation of front propagation is the same as the equation for the front of a light wave. By applying the condition to electromagnetic and gravitational fields at particle production, the Schwarzschild metric (SM) is derived from the classical wave equation which modifies general relativity to include conservation of spacetime in addition to momentum and matter/energy. The result gives a natural relationship between Maxwell's equations, special relativity, and general relativity. It gives gravitation from the atom to the cosmos.
- The Schwarzschild metric gives the relationship whereby matter causes relativistic corrections to spacetime that determines the curvature of spacetime and is the origin of gravity. The correction is based on the boundary conditions that no signal can travel faster than the speed of light including the gravitational field that propagates following particle production from a photon wherein the particle has a finite gravitational velocity given by Newton's Law of Gravitation.
- The limiting velocity results in the contraction of spacetime due to particle production. The contraction is given by where  $r_g$  is the gravitational radius of the particle. This has implications for the expansion of spacetime when a matter converts to energy.
- The spacetime contraction during particle production is analogous to Lorentzian length contraction and time dilation of an object in one inertial frame relative to another moving at constant relative velocity. In the former case, the corresponding correction is a function of the square of the ratio of the gravitational velocity to the speed of light. In the latter case, the corresponding correction is a function of the square of the ratio of the relative velocity of two inertial frames to the speed of light.

- Fundamental particle production occurs when the energy of the particle given by the Planck equation, Maxwell's Equations, and Special Relativity is equal to  $mc^2$ , and the proper time is equal to the coordinate time according to General Relativity. The gravitational equations with the equivalence of the particle production energies permit the equivalence of mass/energy and the spacetime metric from which the gravitational constant and the masses of the leptons, the quarks, and nucleons are derived.

- The gravitational equations with the equivalence of the particle production energies permit the conservation relationship of mass/energy by  $(\rho/c^2)$  and spacetime  $(g_{\mu\nu})$ . Spacetime expands as mass is released as energy which provides the basis of the atomic, thermodynamic, and cosmological arrows of time. Entropy and the expansion of the universe are large scale consequences. The universe is closed independently of the total mass of the universe, and different regions of space are isothermal even though they are separated by greater distances than that over which light could travel during the time of the expansion of the universe. The universe is oscillatory in matter/energy and spacetime with a finite minimum radius, the gravitational radius; thus, the gravitational force causes celestial structures to evolve on a time scale that is greater than the period of oscillation. The equation of the radius of the universe,  $R$ , is  $R = \sqrt{3c^2/\Lambda}$ . The calculated Hubble constant is  $H_0 = \sqrt{\Lambda/3}$ . Presently, stars exist which are older than the elapsed time of the present expansion as stellar evolution occurred during the contraction phase. The maximum energy release of the universe which occurs at the beginning of the expansion phase is  $\rho_{max} c^2$ .

- The relationship between inertial and gravitational mass is based on the relationship between Maxwell's equations, special, and general relativity. Spacetime has an experimentally measurable permittivity and permeability which provides a limiting velocity,  $c$ . This is the key to understanding the relationship between inertial and gravitational mass. Lorentzian contraction and other aspects of special relativity arise from the limiting velocity  $c$  given a particle propagation velocity  $v$ . The limiting velocity  $c$  further results in the contraction of spacetime due to particle production which gives rise to a gravitational field.

- In addition to the propagation velocity, the intrinsic velocity of the particle and the geometry of this 2D velocity surface with respect to the limiting speed of light determines that the particle such as an

electron may have gravitational mass different from its inertial mass. A constant velocity confined to a spherical surface corresponds to a positive gravitational mass equal to the inertial mass (e.g. particle production or a bound electron). A hyperbolic velocity function confined to a flat surface corresponds to a gravitational mass less than the inertial mass which is zero in the limit of an absolutely unbound particle (e.g. absolutely free electron). A hyperbolic velocity function confined to a spherical surface corresponds to a negative gravitational mass (e.g. hyperbolic electron).

A partial listing of the particle and cosmological phenomena derivable from CQM in closed form equations with fundamental constants only is given in Table 1. There is remarkable agreement between predictions and observations [1-3].

Table 1. Partial List of Particle and Cosmological Phenomena Solved by CQM.

- deflection of light by stars • the power spectrum of the universe
- the precession of the perihelion of Mercury • the microwave background temperature
- the lepton masses • the uniformity of the microwave background radiation
- the quark masses • the microkelvin spatial variation of the microwave background radiation (DASI)
- the Hubble constant • the observed violation of the GZK cutoff
- the age of the universe • the mass density of the universe
- the observed acceleration of the expansion • the large scale structure of the universe
- the power of the universe

#### Consequences of CQM Gravity:

- The photon has no gravitational mass. As shown in Chp. 23 of R. Mills [1]:

In Einstein's gravity equation, the Einstein tensor and the stress-energy-momentum tensor are each conservative. This forces conservation of curvature and conservation of mass-energy and momentum. Consequentially, a photon and a gravitational field with corresponding energies must each produce a gravitational field corresponding to the equivalent mass. However, for any kind of wave advancing with limiting velocity and capable of transmitting

signals, the equation of front propagation is the same as the equation for the front of a light wave. If gravity propagates at the speed of light, light travels at  $c$  in all inertial frames, and light gives rise to a gravitation field, then an internal inconsistency arises regarding causality.

Conservation of mass-energy and momentum under the law of the limiting propagation velocity based on Maxwell's equations requires conservation of spacetime with matter-energy and momentum but nonconservation of curvature. Thus, the wave equation conserves matter, energy, and momentum. It further provides for the conservation of these physical entities with spacetime and provides a unifying physical principle that gives an oscillating universe with predictions that are consistent with observation.

Furthermore, in the calculation of the deflection of light by a gravitational field, the mass of the photon was set equal to zero in the Deflection of Light section at Eq. (23.108). The agreement of the observed deflection with that predicted with  $m=0$  confirms that the photon has zero gravitational mass.

- If the electric and magnetic fields are completely eliminated from a region of vacuum space containing an electron such that the electron is completely free and unbound, it may be possible to measure an electron gravitational mass that is less than the inertial mass  $m_{\text{sub } e}$ . The gravitational mass may approach zero in the limit of the electron being absolutely free. With the exclusion of essentially all electromagnetic fields, Witteborn [4] experimentally measured the gravitational mass of the free electron using a free fall technique. The reported result was less than  $0.09 m_{\text{sub } e}$ , where  $m_{\text{sub } e}$  is the inertial mass of the free electron  $9.109534 \times 10^{-31}$  kg.

No perpetual motion scheme is possible, since matter, energy and spacetime are conserved. Absorption of photons by matter occurs with conservation of mass-energy. The inertial and gravitational mass of matter may increase. The conservation of spacetime must also be considered which always forces conservation of mass-energy with regard to gravitation. If an electron is ionized, the ionizing photon propagating at the speed of light is replaced by electric fields of the particles propagating at the speed of light. Due to the current distribution of the electron in the complete absence of fields given by Eq. (3.11 of reference 1) and the limiting velocity condition, the free electron may have a gravitational mass less than its inertial mass. And, the gravitational mass may approach zero in

the free limit.

The universe is electrically neutral. As shown in Chps. 2, 19, and 20 of R. Mills [1], photons may give rise to a corresponding surface charge on which electric field lines may terminate. As given in Chps. 19 and 20 of R. Mills [1]

With the substitution of Eq. (19.7) and the appropriate special relativistic corrections into the orbitsphere energy equations, the following energies, written in general form, are equal

(19.8)

where  $\phi$  is the potential energy. In the case of an electron orbitsphere, the rest mass  $m_0$ , the radius  $r$ , and the electron and positron each experience an effective charge of

(19.9)

Thus, considering the relativistic invariance of charge for the electron, in order to cancel all of the fields between an electron and a nucleus from which it is ionized, 510 keV per electron must be provided in terms of captured photons or the equivalent electric or magnetic stored energies. Then the contraction of spacetime due to capture of photons of zero gravitational mass equals the expansion of spacetime corresponding to the formation of an electron which is free of any fields and has gravitational mass that approaches zero. Spacetime is conserved, which forces mass-energy conservation independently of mass-energy conservation during photon absorption or the storing of electric or magnetic energies.

#### NOW LET'S TAKE AT CLOSE LOOK AT THE QM PREDICTIONS REGARDING THE FREE ELECTRON AND GRAVITY:

- The Schrödinger equation predicts that each of the functions that corresponds to a highly excited state electron is not integrable and can not be normalized; thus, each is infinite.

- The Schrödinger equation predicts that the ionized electron is sinusoidal over all space and can not be normalized; thus, it is infinite.

In particular, it is shown by Mills [5-6] that the solution of the Schrödinger corresponds to the case wherein  $\psi$  fails to vanish. Thus, the solutions with sufficiently large  $\psi$  are infinite. The same problem arises in the case of a free electron that is ionized from hydrogen. If  $\psi$  is imaginary, which means that  $\psi$  is positive, Eq. (42) is the equation of a linear harmonic oscillator [7].  $\psi$  shows sinusoidal behavior; thus, the wavefunction for the free electron can not be normalized and is infinite. Also see [8].

#### Quantum Mechanics is an Incomplete Theory Since It Does Not Explain Gravity or Particle Masses [6].

Quantum mechanics can not explain the existence of particles with precise masses and gives no basis of gravity. In fact, a straight forward application of the Uncertainty Principle predicts that particles of precise mass/energy can not exist. These shortcomings are compounded by the prediction of zero-point field fluctuations, virtual particles, and states of negative energy and mass invoked to describe the vacuum. These consequences of the Uncertainty Principle are nonsensical and have no basis in reality since they have never been observed experimentally. For example, the Rutherford experiment demonstrated that even atoms are comprised of essentially empty space [9]. These consequences of QM would also correspond to an essentially infinite cosmological constant throughout the entire universe including regions of no mass. As given by Waldrop [10], "What makes this problem into something more than metaphysics is that the cosmological constant is observationally zero to a very high degree of accuracy. And yet, ordinary quantum field theory predicts that it ought to be enormous, about 120 orders of magnitude larger than the best observational limit. Moreover, this prediction is almost inescapable because it is a straightforward application of the Uncertainty Principle, which in this case states that every quantum field contains a certain, irreducible amount of energy even in empty space. Electrons, photons, quarks--the quantum field of every particle contributes. And that energy is exactly equivalent to the kind of pressure described by the cosmological constant. The cosmological constant has accordingly been an embarrassment and a frustration to every physicist who has ever grappled with it."

Furthermore, according to the Heisenberg Uncertainty principle of QM, matter may be created from nothing, including vacuum. Taking quantum theory into account, Stephen Hawking [11-12] mathematically proved that blackholes must emit Hawking radiation



comprising photons, neutrinos, and all sorts of massive particles. "The surface emits with equal probability all configurations of particles compatible with the observers limited knowledge. It is shown that the ignorance principle holds for quantum-mechanical evaporation of blackholes: The black hole creates particles in pairs, with one particle always falling into the hole and the other possibly escaping to infinity [12]." This QM theorem represents a perpetual motion machine with regard to spontaneous creation of mass and energy from the vacuum and with regard to gravitation. (QM also predicts a perpetual motion machine of the second kind, see Footnote 2). Contrary to prediction, Hawking radiation has never been observed [13-15]. Classical laws including conservation of matter-energy are confirmed and QM is invalidated.

Footnote 1. Abstract of reference 6:

The Schrödinger equation was originally postulated in 1926 as having a solution of the one electron atom. It gives the principal energy levels of the hydrogen atom as eigenvalues of eigenfunction solutions of the Laguerre differential equation. But, as the principal quantum number  $n \gg 1$ , the eigenfunctions become nonsensical. Despite its wide acceptance, on deeper inspection, the Schrödinger solution is plagued with many failings as well as difficulties in terms of a physical interpretation that have caused it to remain controversial since its inception. Only the one electron atom may be solved without approximations, but it fails to predict electron spin and leads to models with nonsensical consequences such as negative energy states of the vacuum, infinities, and negative kinetic energy. In addition to many predictions which simply do not agree with observations, the Schrödinger equation predicts noncausality, nonlocality, spook actions at a distance or quantum telepathy, perpetual motion, and many internal inconsistencies where contradicting statements have to be taken true simultaneously. Recently, the behavior of free electrons in superfluid helium has again forced the issue of the meaning of the wavefunction. Electrons form bubbles in superfluid helium which reveal that the electron is real and that a physical interpretation of the wavefunction is necessary. Furthermore, when irradiated with light of energy of about a 0.5 to several electron volts [1], the electrons carry current at different rates as if they exist with different sizes. It has been proposed that the behavior of free electrons in superfluid helium can be explained in terms of the electron breaking into pieces at superfluid helium temperatures [1]. Yet, the electron has proven to be indivisible even under particle accelerator collisions at 90 GeV

(LEPII). The nature of the wavefunction must now be addressed. It is time for the physical rather than the mathematical nature of the wavefunction to be determined. A theory of classical quantum mechanics (CQM) was derived from first principles by Mills [2] that successfully applies physical laws on all scales. Using the classical wave equation with the constraint of nonradiation based on Maxwell's equations, CQM gives closed form physical solutions for the electron in atoms, the free electron, and the free electron in superfluid helium. The prediction of fractional principal quantum energy states of the electron in liquid helium match the photoconductivity and mobility observations without requiring that the electron is divisible.

Footnote 2. Flawed Prediction of Perpetual Motion by the Heisenberg Uncertainty Principle (HUP)

Another consequence of HUP wherein entanglement of states is implicit is the prediction of perpetual motion [6]. Schewe and Stein report on the work of Allahverdyan and Nieuwenhuizen [16]:

"Armen Allahverdyan of, CEA Saclay (France)/University of Amsterdam (Netherlands)/Yerevan Physics Institute (Armenia), aarmen@spht.saclay.cea.fr, and Theo Nieuwenhuizen of the University of Amsterdam (nieuwenh@wins.uva.nl, 011-31-20-525-6332) [17] suggest that a quantum particle (such as an electron) interacting strongly with a reservoir of particles may violate the Clausius inequality--one formulation of the second law of thermodynamics, which states that it is impossible to do work without losing heat. What the researchers term "appalling behavior" can be traced to the quantum mechanical property of entanglement, in which a quantum particle (such as an electron) is so strongly interlinked with another particle or group of particles that the resulting behavior cannot be treated by standard thermodynamic approaches. In this paper, the Amsterdam scientists study the entanglement of a particle with a "quantum thermal bath," a reservoir of particles with which the first particle can exchange energy and momentum. According to the researchers, entanglement prevents the quantum bath from observing the normal requirements for a heat bath. Therefore, thermodynamics simply cannot say anything useful about the system.

Standard thermodynamics dictates that the bath be in thermal equilibrium and not interact strongly with an external object. To the contrary, the bath strongly interacts with something external to it (the entangled particle) and it cannot reach equilibrium, since it

constantly exchanges energy and momentum with the particle. At low temperatures where entanglement could be easily preserved, the researchers state that this system can apparently violate the Clausius inequality--in which the heat gained by the particle must be less than or equal to the temperature multiplied by the change in its entropy (or disorder). Near absolute zero temperatures, a situation which would ordinarily require the particle to lose heat, the researchers show that the particle could gain heat, by the Clausius relation. According to this scenario, applying a cyclic parameter such as a periodically varying external magnetic field can cause the entangled particle to extract work from the bath--something forbidden in a classical system. Further, the researchers say that this phenomenon could be said to constitute a perpetual motion machine of the second kind."

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Randy Mills

Also at footnotes 1 and 2 at pages 500 and 501, respectively, of R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, [www.blacklightpower.com](http://www.blacklightpower.com) appears:

1. If the electric and magnetic fields are completely eliminated from a region of vacuum space containing an electron such that the electron is completely free and unbound, it may be possible to measure an electron gravitational mass that is less than the inertial mass  $m_{sub\ e}$ . The gravitational mass may approach zero in the limit of the electron being absolutely free. With the exclusion of essentially all electromagnetic fields, Witteborn [4] experimentally measured the gravitational mass of the free electron using a free fall technique. The reported result was less than  $0.09\ m_{sub\ e}$ , where  $m_{sub\ e}$  is the inertial mass of the free electron  $9.109534 \times 10^{-34}$  kg.

*No perpetual motion scheme is possible, since matter, energy and spacetime are conserved.* Absorption of photons by matter occurs with conservation of mass-energy. The inertial and gravitational mass of matter may increase. The conservation of spacetime must also be considered which always forces conservation of mass-energy with regard to gravitation. If an electron is ionized, the ionizing photon propagating at the speed of light is replaced by electric fields of the particles propagating at the speed of light. Due to the current distribution of the electron in the complete absence of fields given by Eq. (3.11) and the

limiting velocity condition, the free electron may have a gravitational mass less than its inertial mass, And, the gravitational mass may approach zero in the free limit.

The universe is electrically neutral. As shown in the Excited States of the One-Electron Atom (Quantization), Creation of Matter from Energy, and Pair Production sections, photons may give rise to a corresponding surface charge on which electric field lines may terminate. As given in the Creation of Matter from Energy section (also see the Pair Production section):

With the substitution of Eq. (19.7) and the appropriate special relativistic corrections into the orbitsphere energy equations, the following energies, written in general form, are equal

$$E = \hbar \omega^* = mc^2 = V \quad (E = \hbar \omega^* = m_0 c^2 = V) \quad (19.8)$$

where  $V$  ( $V$ ) is the potential energy. In the case of an electron orbitsphere, the rest mass  $m = m_{\text{sub } e}$  ( $m_0 = m_e$ ), the radius  $r = \alpha a_0$  sub zero ( $r_a^* = \alpha a_0$ ), and the electron and positron each experience an effective charge of  $\alpha^{-1} e$  ( $\alpha^{-1} e$ ).

$$V = (\alpha^{-1} e^2) / (4\pi \epsilon_0 \alpha a_0)$$

$$(V = \frac{\alpha^{-1} e^2}{4\pi \epsilon_0 \alpha a_0}) \quad (19.9)$$

Thus, considering the relativistic invariance of charge for the electron, in order to cancel all of the fields between an electron and a nucleus from which it is ionized, 510 keV per electron must be provided in terms of captured photons or the equivalent electric or magnetic stored energies. Then the contraction of spacetime due to capture of photons of zero gravitational mass equals the expansion of spacetime corresponding to the formation of an electron which is free of any fields and has gravitational mass that approaches zero. Spacetime is conserved, which forces mass-energy conservation independently of mass-energy conservation during photon absorption or the storing of electric or magnetic energies.

The energy to ionize an electron is a very small fraction of the 510 keV that is required to identically cancel the field from the nucleus from which the electron is ionized. For example, this can be accomplished with a drift tube described by Witteborn [4] with energy stored in electric and magnetic fields of the corresponding to photons which when propagating have zero gravitational mass and have mass equivalent to their energy according to  $E = mc^2$  ( $E = mc^2$ ) when bound. Thus, creation of a completely free electron with a gravitational mass that approaches zero requires an

increase in gravitational mass due to trapped fields corresponding to photons of exactly the same magnitude. Thus, mass/energy and gravitational energy are conserved, and no perpetual motion machine is predicted or permitted.

2. Witteborn [4] explains the observation that free electrons floated in the drift tube by a postulated Schiff - Barnhill effect wherein the electrons in the metal of the drift tube fall in the Earth's gravitational field to produce an electric field which identically balances the force of gravity on the free electrons in the drift tube. This explanation is absolutely untenable. The binding energy of electrons in metals is typically 5 eV; whereas, the gravitational potential energy over atomic dimensions is over 20 orders of magnitude less and is given by  $E = m_e g h$  ( $E = m_e g h$ ) where  $m_e$  ( $m_e$ ) is the mass of the electron,  $g$  ( $g$ ) is the acceleration of gravity, and  $h$  ( $h$ ) is the metal internuclear spacing, about  $10^{-10}$  m ( $10^{-10}$  m.)

PZ totally missed the 20 orders of magnitude discrepancy between the binding and gravitational energies of electrons in metals in his interpretation of the Witteborn experimental results:

John A. Kassebaum wrote:

>Thus, I think Dr. Mills is just hedging his bets. He just wants to be  
>clear about  
>what a 'free' electron is. It seems likely to me that conduction  
>electrons in  
>metals and ionized electrons in plasmas are free in the same sense,  
its  
>just harder  
>to model.

The binding energies of electrons in metals are typically around 5 eV; whereas, the gravitational potential energy over atomic dimensions is of the order of  $1 \times 10^{-21}$  eV. Thus, metals are electrically neutral and there is no reported measurable electric field produced by the gravitational force. There are very strong electrical restoring forces in plasmas as well which result in ambipolar drift of electrons paired with ions.

Randy Mills

AND

>Mills wrote:

>

>The binding energies of electrons in metals are typically  
>around 5 eV;

>                  whereas, the gravitational potential energy  
>over atomic dimensions is of

>                  the order of  $1 \times 10^{-21}$  eV. Thus, metals  
>are electrically neutral and

>                  there is no reported measurable electric  
>field produced by the

>                  gravitational force. There are very strong  
>electrical restoring forces

>                  in plasmas as well which result in  
>ambipolar drift of electrons paired

>                  with ions.

>

>                  Randy Mills

>

>

Peter Zimmerman wrote:

>>\*\*\*This is clear as mud. The gravitational potential energy  
>>of WHAT over those distances? You need to specify a mass, a  
>>radius for the mass, etc. And a mass for the test mass. The  
>>statement as written is incomprehensible.

>

>>As for no reported measurable electric field produced by  
>>gravity, Schiff - Barnhill states precisely the opposite.

$E = mgh$  where  $m$  is the mass of the electron,  $g$  is the acceleration of gravity, and  $h$  is the metal internuclear spacing, about  $5 \times 10^{-11}$  m.

I would add the Schiff - Barnhill effect to the list of other nonsensical quantum mechanical interpretations of data discussed in my post of 7/12

such as:

1.) virtual particles surround the electron and shield the charge less.

- effectively as the electron's center is approached,
- 2.) spooky action at a distance,
  - 3.) a  $9\text{Be}^+$  ion may be in two separate locations at once,
  - 4.) supercurrent may go in both directions at once,
  - 5.) perpetual motion is predicted
  - 6.) dark energy is causing the expansion of the universe to accelerate

Then there is reality:

- 1.) the electron charge density is greatest in center,
- 2.) photon momentum is conserved on a photon by photon basis rather than statistically as predicted by quantum mechanics,
- 3.) the fluorescence emission spectrum of a Penning trapped  $9\text{Be}^+$  ion shows interference peaks due to coupling between oscillator modes and a Stern Gerlach transition,
- 4.) the energy difference of a superconducting loop observed by Friedman et al. matches the energy corresponding to the flux linkage of the magnetic flux quantum by the ensemble of superconducting electrons in their entirety with a reversal of the corresponding macroscopic current,
- 5.) perpetual motion is not permitted or observed
- 6.) the spacetime expands as matter is converted into energy

Randy Mills

The irony of PZ's position is that according to standard general relativity, the solution of the deflection of light in a gravitational field requires that the gravitational mass of the photon be zero. To avoid an inconsistency with the equivalence principle, a hand-waving argument is offered wherein the parameter  $m$  in Eq. (23.81) which is unequivocally the gravitational mass somehow becomes the photon rest mass. As shown in Cosmology section and in the post above, since the gravitational field and the photon both travel at the speed of light, the photon can not give rise to a gravitational field without violating causality. The zero rest mass argument is made further internally inconsistent by invoking special relativity to magically make the rest mass of the photon be zero, but special relativity absolutely requires that the speed of the photon be  $c$  for all inertial frames with the absence of a special frame. Specifically,



the frame in terms of the historical data is that of an Earth observer, not a photon rest frame. This point was made again in my previous post:

Peter Zimmerman wrote:

> ++Is the good doctor serious when he speaks of bound  
> photons?

I acknowledge that QM has no description for the photon or photons in excited states of atoms as given by CQM at Chp 4 and 2, respectively. But, surely any competent physicist would know that stored electric or magnetic energy can be converted into photons (i.e. stored electromagnetic energy is different from matter and that it corresponds to photons). You must appreciate that electromagnetic energy in a resonator cavity, a maser, and a laser can be considered bound and corresponds to photons. The energy in a capacitor discharges to give photons. The energy in a solenoid dissipates as photons, etc., etc.

> Is he serious when he says that propagating  
> photons have no gravitational mass? If he is, then how does  
> he explain gravitational lensing effects -- whether of light  
> travelling around distant masses, or the simpler case of  
> starlight passing close to the limb of the sun and observed  
> during a total eclipse.  
>  
> Does Dr. Mills forget that this experiment was done the  
> first time around 80 years ago? And that the effects are  
> seen frequently in deep-space images? And that the degree  
> of bending is a sensitive test of General Relativity?

The derivation appears on p.427 to p. 431 of R. Mills, The Grand Unified Theory of Classical Quantum Mechanics, July 2001 Edition, BlackLight Power, Inc., Cranbury, New Jersey, posted at [www.blacklightpower.com](http://www.blacklightpower.com) where I have explicitly indicated where CQM deviates from the past approach:

"The results obtained in the Precession of the Perihelion section can be applied to light propagation in gravitational fields wherein the

gravitational mass of light is zero (rather than the rest mass of light is zero as typically given [5]). Substitution of  $m$  in Eq. (23.81) gives....."

Also from my post of 7/30:

¥ The photon has no gravitational mass. As shown in Chp. 23. (p.437) of R. Mills [1]:

In Einstein's gravity equation, the Einstein tensor and the stress-energy-momentum tensor are each conservative. This forces conservation of curvature and conservation of mass-energy and momentum. Consequentially, a photon and a gravitational field with corresponding energies must each produce a gravitational field corresponding to the equivalent mass. However, for any kind of wave advancing with limiting velocity and capable of transmitting signals, the equation of front propagation is the same as the equation for the front of a light wave. If gravity propagates at the speed of light, light travels at  $c$  in all inertial frames, and light gives rise to a gravitation field, then an internal inconsistency arises regarding causality.

Conservation of mass-energy and momentum under the law of the limiting propagation velocity based on Maxwell's equations requires conservation of spacetime with matter-energy and momentum but nonconservation of curvature. Thus, the wave equation conserves matter, energy, and momentum. It further provides for the conservation of these physical entities with spacetime and provides a unifying physical principle that gives an oscillating universe with predictions that are consistent with observation.

Furthermore, in the calculation of the deflection of light by a gravitational field, the mass of the photon was set equal to zero in the Deflection of Light section at Eq. (23.108). The agreement of the observed deflection with that predicted confirms that the photon has zero gravitational mass.

Randy Mills

Furthermore, competent physicists realize that 500 keV is only  $8 \times 10^{-14}$  J which is trivial. This energy must be expended to perform the Witteborn [4] experiment (which involves tests on individual electrons rather than  $10^{23}$  electrons) in order to preserve conservation of energy and charge neutrality while creating an

electron absolutely free of any electrical fields.

Randy Mills





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## Perpetual Motion: Still Going Around

By Robert L. Park

Special to The Washington Post

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"Every one of you can be disconnected from the central power grid and never pay another electric bill as long as you live!" That's what Dennis Lee promised an audience of several hundred in the gymnasium of a rural high school near Columbus, Ohio, earlier this year.

They were there, and I was there, because of a full-page ad in USA Today. In letters two inches tall, its headline asked:

Tired of High Electric Bills... How About NO Electric Bills?

Columbus was just one stop on a tour of 45 cities across the nation to demonstrate the revolutionary new technology that Lee says can provide infinite free electricity. The centerpiece of his three-hour presentation was an odd-looking contraption of belts and pulleys that he calls "counter-rotation technology."

He says it makes use of something called the "Fourth Law of Motion." Presumably, that allows his gizmo to evade the limitations of Newton's Third Law of Motion -- for every action, there is an equal and opposite reaction.

According to Lee, counter-rotation technology, combined with "permanent magnet motors that are more than 200-percent efficient," can produce infinite free electricity.

But there is no Fourth Law of Motion. And a machine that produces more energy than it is required to run it would violate the most fundamental law of physics, the conservation of energy.

Lee is something of a throwback in the free energy game. The various schemes that his company, Better World Technologies, Inc., has promoted over the years are classical perpetual motion devices from a bygone era.

They rely not on exotic new physics but on a misunderstanding of centuries-old physics -- Isaac Newton's laws of motion and Michael Faraday's laws of electromagnetism, among others. Nonetheless, despite centuries of evidence to the contrary, such claims still have the power to bamboozle and have been doing so for a long time.

## An Old Dream

In 1618, a London physician named Robert Fludd thought that he had a way to turn a water wheel without depending on nature to provide a millstream. He would use the wheel's rotation to drive a water pump. The water that had turned the wheel would be pumped back to the top, where it could fall again. A mill powered by this device would run indefinitely.

Alas, the amount of energy supplied by a water wheel cannot exceed the weight of the water that hits its paddles multiplied by the distance the water descends in turning the wheel. It would take the same amount of energy to raise the water back to the top of the wheel as the falling water produced in the first place. No energy would be left to grind flour.

Of course, the concept of energy or "work" as a measurable quantity did not exist in the 17th century. Fludd's idea failed, but his failure led others to one of history's greatest scientific insights and helped to pave the way for the industrial revolution.

It would be another 200 years before the flaw in Fludd's machine would be stated in the form of a fundamental law of nature: Energy is neither created nor destroyed. But it is conserved. That is, there is always exactly the same amount of total energy around after something happens than there was before it happened.

Written as a mathematical equation, that is known as the First Law of Thermodynamics. There is no firmer pillar of modern science. It explains why a ball, no matter what it's made of, can never bounce higher than the point from which it's dropped. That's consistent with our everyday experience: You can't get something for nothing.

### But Wait, There's More

Even if it ground no flour, Fludd's water wheel still could not be kept turning. Energy losses, including the heat generated by friction in the machinery, are inevitable. That's embodied in the Second Law of Thermodynamics. Our bouncing ball can never bounce quite as high as the point from which it was dropped.

The first law says you can't win; the second law says you can't even break even.

In the 400 years since Fludd's failure, thousands of inventors have tried to beat the laws of thermodynamics. The laws always won. In frustration, and perhaps embarrassment, many inventors have resorted to fraud, constructing complex devices with cleverly concealed sources of energy. Each failure, each fraud exposed, established the laws of thermodynamics more firmly.

In 1911, the U.S. patent commissioner, exasperated by the time wasted on these impossible ideas, ruled that patent applications for

perpetual motion machines could not be submitted until one year after an operating model was filed with the patent office.

If the machine was still running at the end of the year, the application would be accepted. The new ruling seemed to bring an end to patent applications for perpetual motion machines.

In 1983, however, Joseph Newman, a mechanic from Lucedale, Miss., sought to patent an "energy machine" that he said produced more energy than was needed to run it. Newman insisted that his invention was not a perpetual motion machine and asserted that the energy came from conversion of mass into energy according to Einstein's famous equation  $E = mc^2$ . Nuclear power comes from this conversion, but Newman's was not nuclear power.

Slowly, Newman said, his machine was devouring its own copper wires and iron magnets. Because  $c^2$  (the speed of light squared) is such a huge number, his machine would, for all practical purposes, last forever.

Unimpressed, the patent examiner rejected Newman's application. Not a man to be pushed around, Newman filed suit in federal court to force the Patent and Trademark Office to grant a patent for "an unlimited source of energy."

Could Joe Newman, a simple mechanic, have discovered a way to convert copper and iron into electrical energy? A federal judge ordered Newman to turn his energy machine over to what then was called the National Bureau of Standards for testing. Properly measured, the output power was found to be much less than the input power. Newman lost his suit.

But his failure, like that of Fludd, made a contribution. His suit, *Newman v. Quigg* now is cited as the legal justification for rejecting all patent applications involving perpetual motion. The conservation of energy thus became the law of the land as well as a law of nature.

### Beating the System

Nonetheless, plenty of people still claim to have discovered infinite sources of free energy. Indeed, a worldwide network of passionate free energy believers resides just beyond the fringes of the scientific community.

These people generally shun old-fashioned terms such as "perpetual motion." Instead, they speak a language laced with words and symbols drawn from modern cosmology and atomic physics. They may even believe it to be science, just as witches and faith healers may truly believe that they can summon supernatural powers.

Ignored or even ridiculed by other scientists, they dream of redemption when the world finally realizes the truth. They even have their own magazine, *Infinite Energy*, which fills its pages with rosy stories about progress in the quest for free energy, particularly cold fusion. The progress is hard for a nonbeliever to see.

Nevertheless, these claims attract investors.

For example, BlackLight Power of Princeton, N.J., raised \$10 million from power companies on the word of its founder, Randall Mills, that he had discovered a way to produce inexhaustible, low-cost, non-polluting energy from ordinary water. The method: shrinking the hydrogen atoms into an energy state below their ground state. He calls these shrunken hydrogen atoms "hydrinos."

Atoms can absorb energy, much as energy is stored in the spring of an alarm clock when you wind it. As the clock ticks, the energy is released bit by bit in sound waves, friction and the motion of the clockworks. When the clock is fully wound down, a physicist would say it's in its "ground state" -- the state of lowest energy. A state below the ground state is a contradiction of terms.

Mills, whose degree is in medicine and who has no record of accomplishment in physics, describes this as "the most important discovery of all time ... up there with fire." Could he be right? Could there be a state of hydrogen that other scientists had missed?

No.

The energy states of atoms are studied through their atomic spectra -- light emitted at very specific wavelengths when electrons make a jump from one energy level to another. The exact prediction of the hydrogen spectrum was one of the first great triumphs of quantum theory; it is the platform on which our entire understanding of atomic physics is built. The theory accounts perfectly for every spectral line.

There is no line corresponding to a "hydrino" state. Indeed, there is no credible evidence at all to support Mills' claim.

#### Weighty Matters

So many companies are claiming to have discovered free energy that additional claims are needed to set one apart from the competition.

James Patterson, an avuncular, white-haired 75-year-old who complains that his wonderful discoveries take time from fishing, says he also can produce unlimited, non-polluting energy from ordinary water with a device similar to the electrolytic cells of BlackLight Power. But he says the Patterson Power Cell also neutralizes radioactivity.

It would be difficult to find a nuclear physicist who would take such a claim seriously. The only way to neutralize radioactivity, to the extent that it can be done at all, is with a nuclear reactor or a powerful nuclear accelerator. Still, Patterson's company, Clean Energy Technologies, Inc., did well for a time after he appeared on ABC's "Good Morning America" in 1996 and again in 1997.

The problem is that we all want to see miracles. Perhaps scientists do more than others. Many of them were drawn to science by its promise



of miracles. Miracles do occur, more all the time, or at least scientific advances that would have seemed like miracles a few years ago. Besides, who could blame venture capitalists for investing in hydrinos when NASA scientists are investing in gravity shields?

NASA has invested about \$1 million to test the 1992 claim of a Russian physicist, Eugene Podkletnov, that objects placed above a spinning superconductive disk showed a decrease in weight of about 2 percent.

Superconductors are materials, in this case a ceramic, that lose all resistance to electric currents when cooled below a critical temperature. Could the Podkletnov gravity shield be another miracle?

"Let your imagination run wild," a NASA spokesman advised in an interview this year with The Columbus Dispatch. "What could you do if you could cut gravity by 50 percent or negate gravity altogether?"

Well, for one thing, you could build a perpetual motion machine. If Robert Fludd had had a gravity shield, he could have raised the water back to the top of the wheel with less energy than the wheel would generate. All that was missing was the shield.

It's still missing.

NASA has tested one Podkletnov shield. Researchers measured a weight change of only 2 parts per million. Any weight reduction would be a revolutionary discovery, but the researchers noted that such a minuscule effect is at the limit of their measurement accuracy.

Podkletnov was brought to the United States to see whether he could help. He said he was puzzled, that it worked for him. But maybe NASA needed a bigger disk. That's what's happening now; they are building a bigger shield.

You can view this two ways: Either you accept the First Law of Thermodynamics, in which case the fact that a gravity shield would let you build a perpetual motion machine becomes proof that such a shield is impossible, or you figure that the First Law might be wrong and begin searching for a gravity shield.

NASA scientists chose the second option. They are betting against the laws of thermodynamics. No one wins that wager.

The gravity shield motor is the simplest example of an unbalanced-wheel perpetual motion machine. There have been hundreds of attempts to build perpetual motion machines that would run off the force of gravity, relying on complicated schemes for shifting weight from one side of a wheel to the other as it turns.

But shifting the weight always costs more energy than the wheel supplies. That was the problem with Fludd's water wheel.

It's also the problem with another another class of perpetual motion

machines that supposedly extract energy from the surroundings. These usually involve a fluid that vaporizes readily at room temperature. The pressure exerted by the expanding vapor is used to drive a piston.

Such machines violate the Second Law of Thermodynamics. It also takes energy to cool the vapor back into the liquid state so it can power a second stroke of the piston. And that takes more energy than the piston can supply.

Dennis Lee was featuring such a machine two years ago when I saw his show in Hackensack, N.J. He called it the "Fisher engine" and described it as the "most important discovery in mechanical history."

Actually, it was an old idea. A remarkably similar machine was sold to the Navy in 1880 by John Gamgee, a professor who called it the "zeromotor." It didn't work then either.

Another popular notion involves devices that somehow can rearrange and condense energy from a wide area to a smaller one, where it can be put to use. This is a hugely appealing idea. After all, there's enough heat energy in the average snowbank to heat your home for quite a while; it just happens to be distributed in inconveniently tiny amounts throughout billions of snowflakes and air pockets.

Even if it could all be gathered, it would take a great deal of energy to do so -- more than you could ever extract from the snow.

Still, an ambient-heat engine recently was described in a full page ad in *Physics Today*, the monthly magazine of the physics community, by a company called Entropy Systems Inc. Physicists who took time to read the ad were either outraged or incapacitated with laughter.

If the authors of the ad had any intention of bamboozling readers, they chose an unlikely publication in which to make their pitch.

It never pays to underestimate the human capacity for self-deception, but at some point, those who claim to have discovered a source of free energy must begin to realize that things aren't working as they expected.

They are faced with a choice. In one direction lies acknowledgment that perhaps they've made a mistake. The more publicly and forcefully they have pressed their claim, the more difficult it will be to take that road.

In the other direction is denial. The farther they travel that road, the less likely it becomes that they will ever turn back. This is the road to fraud because no matter how many laws they've broken by that time, they cannot break the laws of physics.

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